

ENCYCLOPAEDIA OF
**WORLD
& PEOPLE**



HAROLD SHELTON G K BUCKNALL

**ENCYCLOPAEDIA OF
WORLD AND PEOPLE**

ENCYCLOPAEDIA OF WORLD AND PEOPLE

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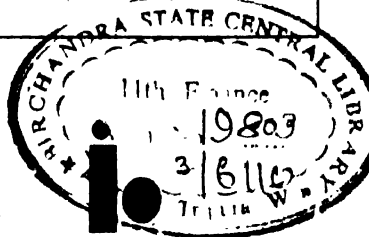
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THE BOOK

VOLUME

EIGHT

SINGAPORE, *sing ga por'*. An island and city forming a part of the British colony of the Straits Settlements.

The Island. The island is about 27 miles long and 14 miles wide, and is separated

in the last hundred years from an unknown settlement to a port of world importance. It is the natural gateway through which many ocean routes between the East and the West must pass.

Sir Stamford Raffles secured the island from the sultan of Johore for the East India Company in 1819, because he recognized its strategic position and foresaw its importance. In 1826 it became a part of the Straits Settlements. It is maintained as a free port, though taxes are imposed on opium, tobacco, spirits, beer, and petroleum. The harbour is good, and excellent docking and warehouse facilities are provided. Singapore's chief industries are tin-smelting, rubber refining and fruit-canning. More than half the total tin output of the world passes through the smelters of Singapore.

Singapore is the capital of the Straits Settlements, and in addition has a separate municipal administrative body appointed by the colonial governor. The governor of the



THE WATER FRONT AT SINGAPORE
Photo: Visual Education Service

from the southern end of the Malay Peninsula by the Strait of Malacca. Its total area is 220 square miles, and in 1935 it had a population of 572,300; most of the people live in the city of Singapore. The population is a cosmopolitan swarm made up of people of many races, with Chinese predominating.

The island is hilly and originally was covered with forest. The climate is practically uniform the year around, and the high relative humidity makes the heat almost unbearable at times. The soil, though not rich, is very productive, owing to the cultivation and enterprise of the Chinese. Para rubber is important, and is first on the list of exports. Coconuts are also extensively cultivated.

The City. Singapore, whose name is from the Sanskrit for "Lion City," has developed

Straits Settlements is also High Commissioner for the Malay States. Schools are state-aided. Raffles College, opened in 1929, gives higher education. A large naval base with pontoon dock was begun in Johore Strait in 1923, and is to be completed in 1939 at a cost of £9,000,000. The air base, of great importance for reconnaissance and defence, is at Seletar, also on the Johore Straits. The city has railway connections



SIR STAMFORD RAFFLES
(National Portrait Gallery)

with Johore Bahru on the mainland, via the Johore Causeway, whence there is a railway to Penang and Bangkok.

SINGING. Musical tones are produced by the same mechanism as speaking tones; that is, the vocal cords are set in vibration by a current of air from the lungs, and these vibrations produce sound. The control of the air column behind the vocal cords is essential in singing, and it is the development of this control that occupies a great part of a singer's training. The muscles involved in correct breathing, particularly the diaphragm, must be exercised, so that the power of the voice may be easily and smoothly regulated. The quality *mesa di voce*, which means the gradual increasing of a tone from very soft, *pianissimo*, to the other extreme of *fortissimo*, and then slowly decreasing the power to the starting point, requires very exact control of the breath and the air volume expelled. The tones of the human voice range over about three octaves, from the bass D to the soprano B flat, though a single voice is not usually capable of more than about two octaves, and the untrained person averages only twelve tones.

In order of pitch, the normal voices of women are soprano and contralto, and those of men tenor, baritone (or light bass) and bass.

SINKIANG, *sin ke ahng'*. A province in the extreme western part of China, comprising what was originally Chinese Turkistan and all Chinese dependencies lying east of Russian Turkistan, between Mongolia on the north and Tibet on the south. The region as a whole, which covers an area of over 550,000 square miles, is a vast barren plateau with mountain barriers on all sides. Along its northern boundary is the long chain known as the Tien-shan Mountains, and the Kuen-lun, Altyn Tagh, and other lofty ranges shut it in on the south. On the east it is penetrated by the desert of Gobi. Much of the natural vegetation borders on that of the Siberian steppes; but where the plateau is drained by the Tarim River and its tributaries, making lines of fertile oases, cereals, fruits, and vegetables are cultivated with the aid of irrigation. Pastoral regions provide wool and hides for commerce, and the mountains yield jade and gold. In the larger towns, silk, carpets, leather goods, and copper ware are manufactured.

The inhabitants, estimated at over 2,000,000, are mostly Mongols and Turkmens. The chief towns are Urumchi, the capital, Kashgar, and Yarkand. Russian influence is strong in the western part.

Kashgar. Former capital of Eastern Turkistan, is situated in an oasis in the western part of the country, on either side

of the Kashgar, a tributary of the Tarim. Population, about 32,000.

The main trade routes from Peking, India, and Russian Turkistan join at Kashgar, and make it an important commercial and trade centre.

Yarkand, *yar kahnd'*, also an important trade centre, lies about 100 miles south-east of Kashgar, on the richest oasis of Sinkiang. The city, which is surrounded by a wall and a moat, is entered by several gates. The inhabitants, largely of Turkmen stock, number 60,000. Agriculture and stock-raising are carried on in the surrounding region; wheat, rice, barley, beans, melons, grapes, and other fruits are produced on the fertile irrigated soil, and goats, yaks, camels, sheep, and cattle thrive on the extensive pasture lands. The minerals include gold, lead, and precious stones, though little besides gold is mined. In addition to leather goods and saddlery, for which Yarkand is particularly noted, the manufactures include carpets, woollens, silks, linens, cotton, and dyes.

SINKING FUND. See NATIONAL DEBT.

SINN FEIN, *shin fayn*. An organization of Irish intellectuals pledged to revive the national language, literature, art, and customs of Ireland, and to establish Ireland as a republic. The society was the outgrowth of other organizations with similar motives, which had been founded in the latter part of the nineteenth century. Arthur Griffith, an Irish politician (1872-1922), was a leader in these movements, and the influence of his forceful pen brought many adherents to the cause. *The United Irishman*, a weekly newspaper established in 1899, for which he wrote, came to be the official organ of Sinn Fein. Its aim was to persuade Ireland to abandon parliamentary action as a means to self-government, and to build up sentiment for a free Ireland within the country itself. In 1902 these ideas were announced in a meeting at Dublin, the parties of which formed an organization which they called the Society of the Gaels. They designated their policy by the Irish words *Sinn Fein*, which are translated "Ourselves"; or, less literally, "Stand together." By 1905 the society, too, was known as Sinn Fein.

The members ridiculed the methods of the Nationalists, and declared that Ireland never properly belonged to the United Kingdom. They set out to develop the economic and industrial life of Ireland, to prepare it for independence. They sought to revive Irish culture, and inspire national consciousness by a recital of the glories of Ireland in history. Their number was small for the first few years, but their zeal and sincerity compensated in a measure for that handicap.

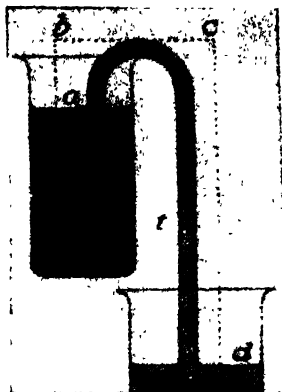
They were not loath to resort to arms, and in April, 1916, they joined the revolutionary elements, and took part in the futile Easter rebellion. The British government executed or imprisoned the leaders of this uprising, but did not succeed in quelling the spirit which prompted it.

In the Sinn Fein convention of 1917, they demanded recognition as a separate nation and voted a republican constitution. Eamon De Valera, a Sinn Fein leader of the Easter revolution who had escaped from Lincoln gaol, was chosen president. They refused to take part in the convention instituted by the British government to study the situation in Ireland and to propose reforms, and they rejected its recommendations. In January, 1919, they issued a declaration of independence, set up a provisional government, and sent delegates to the Versailles Peace Conference. Their delegates were not admitted, but their activities aroused Great Britain to action. (See IRELAND for the subsequent history of the movement.) Since the advent to power of De Valera in 1932, there has been a progressive modification in his attitude of intransigence arising out of a better understanding of the difficulties of the British position. It would appear that he wishes Ireland to remain a member of the British Commonwealth but without having to accept the monarchical principle in Ireland. See VALERA, EAMON DE.

SINUS, *si' nus*. One of the eight cavities in the skull, all of which are connected with the nasal passages by small openings or canals. There are four sinuses on each side of the nose. The two *frontals* are in the forehead just above the nose, and the *ethmoids*, *maxillary sinuses*, and *sphenoids* are in the cheek bones. They are lined with mucous membrane, the secretion of which drains through the nose. Since the sinus and nasal membranes are continuous, infection such as a common cold tends to inflame and congest the sinus membranes, and prevents normal drainage by closing the openings of the cavities. Such conditions give rise to an ailment called *sinus trouble* or *sinusitis*, the chief symptoms of which are headaches or pains around the eyes and in the cheeks, dizziness, and running nose. Sinusitis is dangerous as a focus of infection which may spread to other parts of the body. See CORYZA; NOSE.

SIPHON, *si' fon*. A bent tube with two unequal arms, used to carry a liquid from a higher to a lower level. In the accompanying figure, the liquid (*m*) is forced through the tube (*t*) by the pressure of the air on the surface (*a*), which amounts practically to 15 lb. to the square inch. As long as the pressure at *a* is greater than the weight of the

column of water (*a b*), or until the surfaces (*d*, *a*) are the same level, or *a b* equals *c d*, the flow will continue. Theoretically, a liquid will not flow through a siphon when the highest point in the tube is 33 ft. above the level of surface *a*, because the pressure of a column 33 ft. high is equal to the pressure of one atmosphere. That is, air will sustain the weight of a column of water 33 ft. high (but in practice the height cannot exceed 30 ft.).



PRINCIPLE OF THE SIPHON
The tube (*t*) is the siphon. explanation of the physical law involved appears in the text.

The so-called siphon bottles for aerated water are operated by compressed air or gas. See also BAROMETER; PUMP.

SIREN. An instrument designed originally to measure the number of vibrations in a musical tone of a given pitch. The original form of siren consists of a circular disk perforated with one or more circular rows of oblique holes, and so mounted that it revolves close to another disk perforated with corresponding holes sloping in the opposite direction. The stationary disk is connected with a bellows or some other device by which compressed air, gas, or steam is forced through its holes. When the holes in the revolving disk are opposite those in the stationary disk, a puff of air escapes.

As the velocity of rotation increases, the puffs become more frequent until a clear, continuous sound is produced. The more rapid the vibration, the higher the pitch. For instance, if there were thirty perforations in the disk, and it revolved fifteen times per second, there would be 15×30 , or 450 puffs or vibrations per second. The revolving disk is connected with a system of clockwork which registers the number of vibrations per second, and by use of a siren of this pattern, the number required for any pitch can be easily determined.

A more recent pattern makes use of two perforated cylinders, one within the other, in place of the disks. The outer cylinder revolves.

Very large sirens are used for fog signals at lighthouse stations. Steam is employed in

place of air, and a large trumpet-shaped horn is used to direct the sound.

SIRENIA, *si re' nia*. An order of water mammals of which the only living species are the dugongs and manatees. The special characteristics of these mammals are a rounded head, almost hairless, seal-shaped body, absence of hind limbs, forelimbs paddle-shaped and used only as swimming organs, and a compressed tail expanded from side to side. Sirenians live on aquatic plant food, and frequent marshy shores of both fresh and salt waters. See DUGONG; MANATEE.

SIRENS. In ancient Greek mythology, sea nymphs who lived on an island, and by their exquisite singing enticed mariners to their shore, where they remained, forgetful of home, of friends, and of duty. Odysseus was warned by Circe of the danger from the Sirens, and he stopped the ears of his companions with wax. Being curious to hear the music, he had himself strapped to the mast of his vessel, so that he could not yield to the charm if he wished to.

SIRIUS, *sirrius*, THE DOG STAR. The brightest star in the heavens and one of those nearest to the earth (see CENTAURUS). It is still so distant, however, that its light takes nine years to reach the earth. A line drawn eastward through Orion's belt points at the Dog Star, the head of Canis Major. It is a star of first magnitude, radiating twenty-six times as much light as the sun, and according to recent calculations is approaching the earth at a speed of 9 miles per second.

A companion star to Sirius was discovered in 1862; this is one of the most remarkable objects yet found in the universe, having the unheard-of density of 50,000 times that of water. A cubic foot of such material would weigh about 1500 tons.

SIROCCO, *sir rok' o*. The name given to a south-east wind which reaches the Mediterranean coasts of Italy from Algeria. It is dry and laden with dust from the Sahara.

SISAL, *sis' al*. A tropical plant whose long, swordlike leaves yield a valuable fibre. There



CUTTING SISAL LEAVES IN YUCATAN, MEXICO
Photo: International Harvester Co.

are several different plants that are the source of fibre bearing the name sisal, but the one of greatest commercial importance is *Agave sisalana*, found originally in the peninsula of Yucatan. The plant is grown



SISAL GROWING IN KENYA COLONY
Photo: Cherry Kearton

for the trade mainly on large plantations in several of the British colonies of Africa, in Ceylon, in the East and West Indies, and in the Philippines. The process of fibre-gathering begins with cutting the leaves at the base and removing the spine from the top. They are then fed to machines which strip off



DRYING SISAL IN YUCATAN, MEXICO
Photo U. S. U.

the pulp and clean the fibre; this is yellow-white in colour, strong and lustrous. The leaves yield from 3 to 4 per cent of their weight in fibre. Sisal is used chiefly for twine and rope (sisal hemp).

SISKIN. A small stoutly-built bird of the finch family, and closely related to the goldfinch. It has long been known as a cage-bird, but rarely lives long in captivity. The siskin as a nesting-bird is known most commonly in Scotland and northern England. In the rest of Britain it is mainly a winter visitor.

Scientific Name. The siskin is of the family *Fringillidae*. It is *Spinus spinus*.

SISYPHUS, sis' si fús. A mythical king of Corinth, in ancient Greece. He outwitted Death and bound him in fetters, so that there was great rejoicing all over the earth, for no man died. Ares set Death at liberty, and Sisyphus was set the task of rolling a boulder up a steep hill, but he could never complete it, for as he reached the hill-top the boulder would always escape his control and roll to the bottom again.

SITWELL FAMILY. Edith, Osbert and Sacheverell Sitwell, the three children of Sir George Reresby Sitwell, fourth baronet, have all achieved distinction in literature and art. Edith published many poems between 1915 and the present time, her works including *Clowns' Houses*, *Bucolic Comedies*, *Sleeping Beauty*, *Elegy on Dead Fashion*, *The English Eccentrics*, and, in conjunction with her brother Osbert, *Aspects of Modern Poetry*. Osbert Sitwell (born 1892) has

written plays and novels as well as poetry. His published works include *Twentieth Century Harlequinade and other Poems*, *Out of the Flame*, *Argonaut and Juggernaut*, *Discussions on Travel, Art and Life*, *England Reclaimed*, *Penny Foolish* and *Collected Poems and Satires*. The lyrical poet, Sacheverell Sitwell, is the younger of the brothers; he was born in 1900. He founded in 1924 the Magnasco Society. He has published many volumes of poetry, also *German Baroque Art*, *The Gothic North*, *The Visit of the Gypsies*, *Doctor Donne* and *Gargantua*, *Canons of Giant Art*, *Life of Liszt*, *Touching the Orient*, and other works. A recently published work is entitled *Dance of the Quick and the Dead*.

SIVA, se'va. The third god of the Hindu triad, consisting of Brahma, Vishnu, and Siva. Siva is regarded as the destroyer, and is represented with five heads and three eyes. In some interpretations, he is considered a regenerator, because through death a new life is possible, the word *Siva* itself is Sanskrit for "gracious, or auspicious." See BRAHMA.

SIXTUS. The name of five Popes of the Roman Catholic Church, of whom the most important were Sixtus IV and Sixtus V.

Sixtus IV (1414-1484). FRANCESCO DELLA ROVERE was of humble family, but by his undoubted ability won promotion in the Church until, in 1467, he attained the rank of cardinal. Four years later he was elected to the Papal chair on the death of Paul II. He beautified Rome in many ways and built the Sistine Chapel. He died in 1484.

Sixtus V (1521-1590). FELICE PERETTI was of humble parentage. In 1566 he was created Bishop, and in 1570 cardinal. There was doubt at his election as Pope, in 1585, as to what policies he would pursue. From the first he showed great vigour, firmness, and zeal for reform, directing his efforts especially against the bands of robbers and outlaws who infested the country, and in promoting public works. He advanced the cause of the Church as against the newly risen Protestantism, but reproved Philip II for the excessive severity which was practised in Spain in the name of the Inquisition. Sixtus fixed the membership in the College of Cardinals at seventy.

SIZE. A preparation of glue or flour paste made in such proportions as to remain glutinous; used by decorators for preparing interior surfaces for paint.

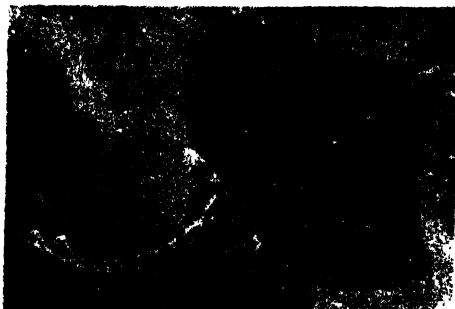
SKAGERRAK, skag' ur ak. This is a broad arm of the North Sea, which divides

Norway and Sweden at the extreme south and separates those two countries from Jutland.

SKALDS, *skalds*. Among the Scandinavian races, the name given to the poets who in a measure corresponded to the bards of Great Britain. They lived at the court of some prince, and sang the praises of living heroes and warriors, or exalted the ancestors of their patron.

SKATE. The name of certain flat-bodied fish. A typical skate has a pointed snout,

the skater bound a bone to his foot and used a staff to aid him in sliding over the ice. A modern skate is a steel blade affixed to a wooden or metal base. It is fastened to the shoe by means of straps, clamps, or screws. The blade may be constructed for special purposes, as for racing, for figure or fancy skating, and for ice hockey (which see). The light, long, all-metal blade is especially adapted to speed, while the rocker-shape blade is particularly desirable for fancy skating. The substitution of wheels for the



SKATE
Photo: Weller

expanded pectoral fins which form with the body a rounded disk, and a slender tail that has lost its function of locomotion and is used only as a rudder. Skates are usually found on sandy bottoms not far from shore. They feed on molluscs, crustaceans, and fishes. Most species are edible.

Scientific Name. The common skate of British waters is *Raja batis*.

SKATES AND SKATING. The sport of skating dates back to primitive days, when



FIGURE SKATING
Photo: Photopress

blade has resulted in the roller skate, which does not require ice, but can be used on any smooth, solid surface.

For centuries, skating has been a popular sport among people of Northern countries. It was earliest developed by the Norsemen, Swedes, Danes, Finns, and Dutch.

SKEGNESS. An Urban District and watering-place situated on the Lincolnshire coast with an area of 4,112 acres and a



SKEGNESS
North shore gardens and pier
Photo: Skegness Corporation

population of 9750 in 1931. The town is of modern origin and has grown in recent years, since its fine sands and bracing air have made it a popular holiday resort. The countryside surrounding the town is mostly flat and is divided by a number of canals, but is conspicuous for the numerous windmills which it has retained. Somersby, the birthplace of Lord Tennyson, is near at hand, whilst the churches of Winthorpe and Croft are well-known for their antique woodwork.

SKELETON. The bones of all vertebrate animals are joined together to form a symmetrical, flexible core which gives shape to the body, constitutes a protecting framework for the vital organs, and serves as a source of attachment for muscles and as a system of levers for muscular action. In man there are about 200 separate bones in the skeleton (see accompanying diagram), all fitted together and held in place by strong bands of flexible tissue. These bones are grouped into two main divisions, the *axial* and the *appendicular* skeletons.

Axial Skeleton. This is made up of the bones of the head, neck and trunk. Its nucleus is the spine (also called spinal column and backbone), which forms an axis for the support of the other parts of the body. In the upper portion are twenty-four separate bones called *vertebrae*, seven of which (*cervical*) are in the neck, twelve (*dorsal*) in the region of the chest, and five (*lumbar*) in the loins. Resting on and attached to the first cervical vertebra is the *skull*, which is composed of twenty-two bones, all except one (the lower jaw) immovably fixed together. Of these bones eight form the *cranium*, a hollow case for the protection of the brain, and fourteen belong to the face. To the dorsal vertebrae are attached the ribs, there being twelve on each side. The upper ribs are fastened in front to the breastbone, or *sternum*. Below the last lumbar vertebra is the *sacrum*, which consists of five separate bones in infancy, but of one solid structure in the adult. At the tip of the spinal column is the *coccyx*, consisting of four bones and representing a rudimentary tail. The sacrum and coccyx are regarded as continuations of the vertebral column. The twenty-four vertebrae are joined together firmly by ligaments

which allow only a small amount of movement, and their bodies are separated from one another by the lens-shaped and elastic



PRINCIPAL BONES OF THE SKELETON

1. Cranium. 2. Vertebrae. 3. Ribs. 4. Scapula or shoulder-blade. 5. Clavicle or collar bone. 6. Hip bone. 7. Coccyx. 8. Pubis. 9. Sacrum. 10. Femur or thigh bone. 11. Patella or kneecap. 12. Tibia. 13. Fibula. 14. Tarsal bones. 14A. Metatarsal bones. 15. Phalanges. 16. Sternum. 17. Humerus. 18. Ulna. 19. Radius. 20. Carpal bones. 21. Metacarpal bones. 22. Phalanges.

intervertebral substances, which prevent jarring, like the springs of a motor-car; behind they form a canal which contains and protects the spinal cord (which see).

Appendicular Skeleton. The parts of the appendicular skeleton are attached to the central axis in such a way as to afford great freedom and variety of movement. This portion of the framework consists of the arm bones and the shoulder girdle (*pectoral arch*) and the leg bones and hip bones (*pelvic arch*). The pectoral arch is formed by the collar bones and shoulder blades; the hip bones, or pelvic arch, by a single structure called the *os innominatum* (bone without a name).

SKI, shoe. The ski which originated in Norway, is a long, narrow, contrivance, usually 6½ ft to 7 ft. in length, made of ash, hickory or oak, which is strapped on to the foot by a special attachment, and slightly curved at one end, sledge fashion, and grooved down the middle to prevent congealing of the snow. On skis movement over the snow is surprisingly easy, and though just a little awkward to control at first, after practising turning, etc., the movement becomes quite simple and an adept skier may perform very marvellous feats on his ski. High speeds are

consists of two main layers: (1) the *cuticle* or *epidermis* (from the Greek *epi*, over or



CROSS SECTION OF THE SKIN

(Greatly magnified)

(a) Scarf skin, or dead epidermis, (b) growing layer of epidermis; (c) layer of cells filled with coloring matter, (d) true skin, (e) fatty tissue, (f, g, h) sweat gland and duct (i, k) hair with follicle and papilla; (j) sebaceous gland



SKI-JUMPER TAKING OFF

Photo: OROC

also attainable; the official record being 66 m.p.h. and the unofficial 78-93 m.p.h.

SKIN. The skin is the structure which covers the entire outer surface of the body. It has four main functions; as a protection for the deeper tissues, as an organ of the special senses of touch, heat and cold, pain, and others less readily defined, as a regulator of the temperature of the body, and for the excretion of certain waste products. It

upon, and *dermis*, skin) and (2) the *true skin* or *dermis*.

The Epidermis. The top layer is made up of countless cells placed side by side like the paving stones in a street, but instead of one compact row, there are perhaps twelve or fifteen rows, arranged one above the other. These cells grow from the bottom up. In the lowest row, they are column-like in shape, and their long axes are perpendicular to the cells of the under skin. Above are several rows of roundish cells which grow flatter and flatter as the surface is approached. They also become drier as they are pushed upward by new cells below, and when the surface is reached, they are shed off in thin flakes. In the deeper cells of the epidermis are found nerves, but there are no blood-vessels in this layer. A cut which draws blood must be deep enough to reach the dermis. In the deeper layers is also found the pigment which gives colour to the skin.

The Dermis consists of a closely woven network of connective tissue, from ¼ in. to ½ in. thick, within which are embedded blood-vessels, lymphatics, nerves, glands, and hair follicles. In its lowest part the dermis passes gradually into a loose network of

fibres called *areolar subcutaneous tissue*, which allows the skin to move freely upon the parts below. On the outer surface of the dermis are innumerable elevations about one two-hundredth of an inch in length, called *papillae* (from the Latin word for *pimple*). The papillae fit into tiny pits on the under surface of the epidermis, so that the two layers are firmly moulded together. In the papillae are found the nerves that give the sensation of touch. The fine ridges on the balls of the fingers and thumb show where the epidermis falls in between adjacent rows of papillae.

The Glands. These are of great importance. There are two kinds, those that pour out sweat, or perspiration, and those that discharge oil. The sweat glands are minute tubes that extend from the surface of the body down to the subcutaneous tissue. There are over two million of them, distributed over the surface of the entire body, but most abundantly on the palms, the soles, and the forehead. It is by means of these glands that the skin performs its functions of regulation of temperature and of excretion, the former by regulating the amount of sweat evaporated. The oil (*sebaceous*) glands, which generally open into hair follicles, secrete an oily substance that prevents the skin from becoming too dry.

[*Epithelium* is the general term for the outer skin and tube linings, as distinct from the *endothelium*, or lining of serous cavities, e g. heart, blood-vessels, etc.]

SKIN SENSATIONS. See SENSATION.

SKUA, *sku'* a. Large gull-like sea-birds found mainly in Arctic and Antarctic regions. The American skuas—called jaegers—are slightly smaller. Skuas are generally dark-coloured and the powerful bill is strongly hooked at the tip. They are carnivorous and

disgorge a recent meal, which the skua recovers before it reaches the water.

The great skua is a common bird in the Shetlands, where it is called bonxie.

Scientific Name. *Megalestris skua*.

SKUNK. A common member of the weasel family, native to North America. It is closely related to the European polecat (which see). The skunk is distinguished by its peculiar means of defence, a pair of glands containing a fluid of strong, offensive odour that is ejected with considerable force when the animal defends itself. It is stockily built, about the size of a large cat, with a



SKUNK
Photo: U. & U.

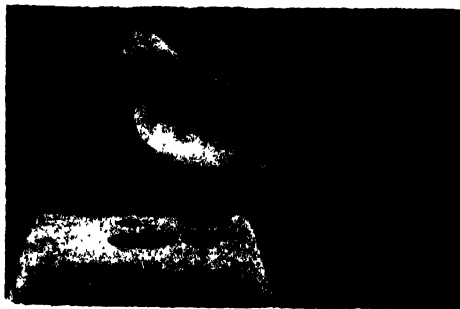
long, pointed nose and an arched back, short legs, and a mincing gait. The fur, which is long, thick, and shiny, is black, marked with prominent white stripes down the back and a white patch on the forehead. The long, bushy tail is black on top and white underneath. The skunk lives in a hollow tree, a burrow, or under wooden shacks, and feeds upon insects, mice, reptiles, squirrels, eggs, and poultry. Nine species are known.

The skunk is one of the most valuable fur-producing animals in North America.

Scientific Names. Skunks belong to the family *Mustelidae*. The common skunks of Eastern North America are *Mephitis mephitis* and *M. putida*.

SKYE, *ski*, ISLAND OF. See HEBRIDES.

SKYE TERRIER. The Skye terrier, which takes its name from the Island of



RICHARDSON'S OR ARCTIC SKUA
Photo: John Kerton

parasitic in their habits; they feed on small birds and mammals, and on carrion. By harrying larger birds they force them to



SKYE TERRIER
Photo: Fall

Skye, although often regarded as a lapdog, is a hardy, game little terrier, very speedy in spite of his short legs, and formerly was

used for badger-hunting. He has altered very little in appearance, during the many years of his existence, except in size, present-day dogs being very considerably larger. The size is indicated by a weight of from 25 to 28 lb., height as much as possible under 10 inches at the shoulder, and the longer the body the better. He has a long level back, short straight legs, deep chest and powerful jaws. The hazel brown eyes, set close together, are veiled by the hair, which should be dark or light blue, grey fawn or cream. The ears may be either prick or drop. Carriage of the gracefully feathered tail is important. It should hang down in a curve, without curl or ring. The weather-resisting coat is double—the underjacket short, close, soft and woolly, the outer long, averaging 5½ in., hard, straight, flat, and free from crisp or curl.

SKYSCRAPER. See illustrations under ARCHITECTURE; NEW YORK CITY.

SLAG. A stone-like compound formed in the process of extracting metals from their ores. It contains silica, alumina, lime, and various earthy substances, together with a small quantity of the metal from the reduction of which it results. Various economical uses have been found for this by-product. When reduced to powder, it is used in making mortar, and as a fertilizer. From iron slag an imperfect glass is manufactured, from which vases and various small articles are made. Melted slag is used to impart a glaze to bricks, and it is used largely in cement-making.

SLANDER. Defamatory words uttered orally. Written or printed defamation of character is *libel* (see LIBEL, for more complete description). Most of the law of libel applies equally to slander, but with two exceptions. First, the uttering of a slander, as such, can never be a criminal offence. The sole remedy of the injured party is to bring an action for damages. The second respect in which the law of slander differs from that of libel is that (except in the four cases mentioned below) no action can be brought for a slander without proof of "special damage," i.e. a plaintiff must show some particular way in which the slander has directly caused him injury. But to this last rule there are four exceptions, namely: any slander imputing (a) unchastity to a woman, or (b) that the plaintiff has been guilty of a criminal offence punishable by death or imprisonment, or (c) that he is infected with venereal disease or leprosy, or (d) that he has been guilty of misconduct or incompetence in his profession, trade or office.

SLANG. A mode of language which departs from the standard or accepted mean-

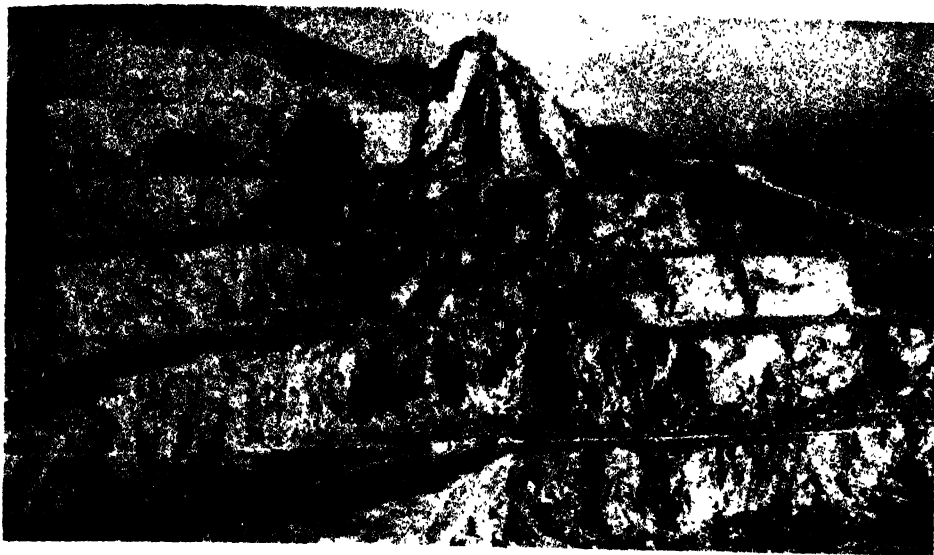
ings of words and phrases, and gives them arbitrary implications which are novel, vivid, grotesque, expressive, and sometimes vulgar. Originally, the term meant the cant of thieves, beggars, and tramps, who use a special jargon to keep others from knowing what they mean. Thus, unless their turns of speech are explained, the uninitiated are not expected to know that a "lag" means a convict, and a "cove" a man. Slang to-day has a wider scope, and refers to the words and expressions outside the conventional vocabulary which are in popular use because they are apt and the vogue, and not because the speaker desires to conceal his meaning. Educated people use slang deliberately and consciously, as a relief from the stiff and conventional manner they are compelled to adopt on other occasions.

One of the characteristics of slang is that it is short-lived; another, that phrases popular at the moment are overworked, and therefore limit the vocabulary, because on every possible occasion that term is used, and more proper words are temporarily neglected. On the other hand, certain slang expressions are so vivid and provide so many new and useful shades of meaning that they find their way into the dictionaries, though usually with a label, such as "slang" or "colloquial." Such terms as "skyscraper," "bootleg," "vamp," "jazz," and "highbrow," have come into general usage.

SLATE. A rock or stone formed by the metamorphism, or alteration by heat and pressure, of less compact material. Most slates have been formed by the compacting of muds, clays, or other fine-grained sediments, but some have their origin in basalts, volcanic ash, or other igneous rocks. Many slates are metamorphosed shales.

Slate splits into thin layers, and varies in colour from light grey to green, red, brown, and almost black. It is of different degrees of hardness, but all varieties are easily scratched with a knife. It is found in all localities where metamorphic rocks have been formed, and the layers are often tilted at various angles. It is one of the most durable rocks, withstanding weathering as well as granite. Slate is used for sanitary and electrical appliances. Marbleized slate is made by painting the background on the stone, dipping it in water upon which the colouring matter has been spread, and then baking the stone. Very beautiful designs are produced in this way. The commonest use of slate is in the roofing of houses. It is also used for school blackboards.

The most important quarries in the world are in Wales, especially at Penrhyn and Ffestiniog. The various sizes of slates are known as "ladies," 8 in. by 16 in.;



PORTION OF THE SLATE QUARRY, DINORWIC, NORTH WALES

"countesses," 10 in. by 20 in.; "duchesses," 12 in. by 24 in.; "princesses," 14 in. by 24 in., etc.

SLAUGHTER-HOUSE. See ABATTOIR.

SLAVERY. The practice whereby some men are possessed by others as chattels and bound to their service without any right of recompense or liberty.

When Abraham made his covenant, it applied both to Abraham's family and to him "that is born in the house or bought with money of any stranger," and slavery continued among the Hebrews until they themselves were carried away into captivity. But the laws of Moses provided that all slaves should be well treated, that a Hebrew servant should go free after six years, and that a foreigner should be liberated in the year of jubilee, which occurred twice in a century.

The story of Odysseus' visit in disguise to the swineherd Eumaeus teaches us that, in Homer's time, slaves were kindly treated, and that they were purchased from pirates and were sometimes of higher birth than their masters. Later, it was customary for men in poverty to sell their children or publicly abandon them, and for debtors to sell themselves for their debt.

In Rome, slavery flourished as long as the legions continued their conquests. Wealthy men maintained large numbers of slaves recruited from war, piracy, and a slave trade. The advent of Christianity had less to do with the end of Roman slavery than the stoppage of the sources from which slaves were drawn, and the growth in power of the existing slaves.

Modern Revival of Slavery. Just before the middle of the fifteenth century, Portuguese explorers in Africa were given several black slaves in ransom for Moors whom they had captured, and the Portuguese began the capture and transportation of negroes into Europe. In 1516 Charles V of Spain gave permission to carry African slaves into the colonies, as the native Indians could not stand up to work in the mines, and so profitable did the trade prove that several nations engaged in it. Towards the end of the eighteenth century the British were carrying more than half of the blacks that were brought to the Western world.

Though Denmark was the first nation to decree the end of the slave trade, in 1792, it was in England that the great fight against it was begun. The Quakers started the movement in 1671. Through the efforts of Thomas Clarkson and William Wilberforce, the House of Commons passed a bill against the trade in 1792, but the Lords did not approve the step until 1808.

Great Britain freed all slaves in its colonies in 1833, and other European nations gradually followed.

Though no slavery exists in civilized countries anywhere in the world to-day, the less enlightened parts of Africa still retain remnants of the trade.

SLAVONIA, *slā vo' nia*. See CROATIA AND SLAVONIA.

SLAVS, *slavuz* or *slavz*, OR **SLAVONIANS,** *slā vo' nians*. The general name of a group of Indo-Europeans, a branch of the family who live chiefly in Eastern Europe

and Siberia. They number approximately 200,000,000, according to recent estimates, and include many Russians, Poles, Wends, Ruthenians, Czechs (Bohemians and Moravians), Slovaks, Slovenians, Croats, Serbians, Bulgarians, Montenegrins, and the peoples of Bosnia and Herzegovina.

The primitive meaning of the term Slav was *speech*. Their original lands were in the valleys of the Vistula, Pripet, and Dniester. Hemmed in by Germans on the one side, and Magyar and Turkish tribes on the other, the southern Slavs would very probably have become assimilated but for the efforts and ideals of such leaders as John Comenius (1592-1670) and Joseph Dobrovsky (1753-1826), who inspired movements on Pan-Slavism and besought their fellow Slavs to preserve their language, literature, and culture.

In 1830 there was organized in Russia the Slavophiles, a society born with the ideal of arousing national consciousness, uniting the elements of the Slav race by a common language, and reviving their literature and history.

Pan-Slav congresses were held in 1848, and again in 1867, at which time Neo-Slavism replaced the old Slavophil movement, and the right of all the Slav nations to work out their own destiny according to their own ideals and background was asserted. Everything dear to them had been taken from them—their children were not allowed to use the Slav languages in the schools, they had no representation in the governments of countries in which they formed the greatest portion of the population, and their literature was suppressed. Yet, when opportunities presented themselves, each element of the Slav race was so intent on its own aspirations that it was unwilling to make the sacrifices necessary for harmony in a united Slav nation.

Following the World War, at the Peace Conference, where self-determination and the rights of small nationalities were cardinal principles, the Slav races under foreign control told their story and put their case. As a result, Czechoslovakia, composed chiefly, as the name suggests, of Czechs and Slovaks, was made a new and independent republic. Yugoslavia, another creation of the Peace Conference, is made up of Southern Slavs—Croats, Serbs, Montenegrins, etc. Ukraine, containing most of the Ruthenians, was set up as an independent state in the Union of Socialist Soviet Republics, while the remaining Ruthenians, who live in Galicia, had to remain under Polish rule.

SLEAFORD, *slé' fôrd*. This Urban District and market town, the "official capital" of Kesteven, Lincolnshire, is 112 miles from London on the L.N.E. railway, and has a

population of 7024. It is an agricultural centre and has maltings and corn and seed warehouses. It was originally a small Roman station off the great highway of Ermine Street, and takes its name from the River Sleas which winds its way through the town. Its notable buildings include a church dedicated to St. Denys. There are ruins of a castle dating from 1130.

SLEEP. The state during which the body renews the energy expended during the waking hours. Throughout the active hours of the day energy is used up faster than it is stored, and the tissues are worn faster than cells are formed to repair them; therefore, both the mind and body need periods of rest. The most complete rest is found in sleep. The conscious activities of the mind cease, the heart beats more slowly, the respiratory movements are shallower and less frequent, and the muscles are relaxed.

An infant sleeps most of the time; a young child needs twelve hours of sleep out of the twenty-four; while eight hours are ordinarily sufficient for the adult. Sleep at night is more refreshing than that in the daytime. It is deepest during the second hour after going to sleep, and a greater shock is received if the sleeper is awakened during this hour than at any other time.

The value of sleep varies with the physical and mental condition of the sleeper. The coverings of the bed should be sufficient to keep the sleeper perfectly warm. They should not, however, be heavy or press too closely upon him or their pressure will prevent his thorough relaxation. A frequent cause of poor sleep or failure to fall asleep quickly lies in cold feet. Cool, freely circulating air to breathe is essential for healthy sleep. The muscles cannot be adequately rested unless the sleeper is free to move and turn, so as to rest first one set of muscles and then another. A sagging mattress or a narrow bed may be disturbing factors in this respect. Meals late at night are to be avoided, for they keep the digestive system active when it should be at rest.

Sleep may be disturbed by psychological conditions as well as by physical ones. After a night of bad dreams we wake up as tired as when we went to bed. Anxiety and worry are determined enemies of sleep, and may result in unrefreshing sleep or the inability to sleep (insomnia). In nervous disorders (neuroses), where anxiety plays so large a part, disturbed sleep and insomnia are among the most distressing symptoms.

The inability to sleep may result from mental or physical exhaustion. A bed that is made specially comfortable, hot milk before going to bed, and cheerful rather than tiring or depressing occupations during the

evening are all helpful. If the insomnia is marked a doctor should be consulted.

SLEEPING SICKNESS, OR **TRYPANOSOMIASIS**. A disease caused by certain species of animal parasites. It is prevalent in parts of Africa, and is transmitted to man through the bite of the tsetse fly. The early symptoms are irregular fever, headache, and weakness. The glands all over the body are enlarged, and a red eruption appears on the skin. Later, the course of the disease is commonly drowsiness, somnolence, coma, and death. The disease is nearly always fatal to white men, unless checked in the early stages. The so-called Rhodesian type is more acute, more rapidly fatal, and more resistant to drugs than other forms.

Sleeping sickness is treated by arsenic compounds, antimony compounds, and by a secretly composed drug of German invention, called *Bayer 205*. The latter is especially useful in treating white men infected with the Rhodesian type.

Prevention and control of sleeping sickness are being studied by an international commission.

SLEEP-WALKING. See **SOMNAMBULISM**.

SLEEPY SICKNESS, OR **ENCEPHALITIS LETHARGICA**. A disease caused by an organism not yet isolated. It has been known only since 1915. It is totally distinct from sleeping sickness (which see), and its technical name means *inflammation of the brain with resulting lethargy*. Its symptoms vary very widely, and it is often extremely difficult to recognize. There may be in the early stages slight rise of temperature, headache, some degree of paralysis, especially about the face, double vision, lethargy, mental dullness, constipation. If improvement does not occur, after one, two, or more weeks the patient becomes acutely ill, and lethargy becomes pronounced. No specific treatment is known. Roughly speaking, one-quarter of all cases are fatal, one-quarter recover completely, and one-half are left with some permanent defect of the nervous system or the mind. Since a severe epidemic in 1918, cases have become less frequent; it is now rare.

SLICKENSIDES. The smooth striated sides of faults caused by the slow movement of the sides of the fissure on one another.

SLIDE RULE. A mechanical instrument for making arithmetical, algebraical, and trigonometrical calculations. It consists of a ruler with a sliding medial section; both the ruler and the slide are graduated and have similar logarithmic scales printed on their corresponding edges. A runner, or indicator, made of a transparent glass or celluloid, and having a vertical line drawn down the middle, is used to fix coinciding points on the scales. Although a know-

ledge of logarithms is not necessary for the employment of the slide rule, full use of the instrument cannot be made without some knowledge of the subject.

SLIGO, *slí' go*. A seaport and market town on County Sligo in the west of the Irish Free State, with a population of 11,437. It occupies a beautiful position on the River Garavogue, and is a holiday and tourist centre. Its industrial interests include shipping, flour milling and fishing. Sligo Town was constituted a borough in 1612. In earlier times it had been the scene of many conflicts between the warring forces of the day. The ruins of Sligo Abbey are the remains of the oldest building in the town. The original building was founded in 1252 for Dominican monks, but this was burnt down in 1414. The present ruins are those of a later building.

SLIME MOULDS. Minute plants of very simple structure which usually are found upon decaying wood and on soil containing a large proportion of humus. Some of them subsist as parasites on cultivated plants. The slime moulds are of special interest because of their resemblance to minute animals, though the consensus of opinion is that they are more botanical in character than zoological. The spores germinate in moist soils and in humus, forming a simple cell with a single slender, hairlike attachment, by means of which the organisms swim about. Later, they lose the flagellum (the hairlike attachment), and the cells unite in a common mass which has the appearance of jelly—a plasmodium (the vegetable body of slime moulds), with the power of slow creeping movement. Finally, the plasmodium develops into masses of mould-like spores.

SLIMMING. See **FAT**.

SLING. A weapon of very ancient origin, for throwing stones or other missiles. In its simplest and oldest form it consists of a leather or hide strap, to each end of which is fastened a string. The stone or other missile to be thrown is placed on the strap, and the operator holds the two cords in his hand. Whirling the sling rapidly round his head to attain velocity, he releases one end, and the missile is discharged with the initial velocity at which the sling is being whirled at the moment of release.

The ancient inhabitants of the Balearic Islands were famed for skill with the sling, and its use was of great value to the armies of Egypt, Greece, and Rome. In the Middle Ages, slings attached to a staff were used to hurl big stones against fortifications.

SLOANE, SIR HANS (1660-1753). A British physician and collector whose private museum formed the beginning of the British Museum, London.

SLOE, *slō*. A spiny, branching shrub, related to the plum and found in Europe, Central Asia, and parts of North America. It has pure-white blossoms, which appear before the leaves and later give place to small, black fruits about the size of a pea. The latter are used for making wine, jelly, preserves, and dyes. Walking sticks and tool handles are made from the hard wood of this shrub. It is also called *blackthorn*.

Scientific Name. The sloe belongs to the rose family, *Rosaceae*. Its botanical name is *Prunus spinosa*.

SLOOP. A smaller type of warship. In the old sailing navy, sloops were cruising vessels next below the frigates in force. The largest of them had three masts and mounted 18 light guns or carronades. With the



A MODERN SLOOP: H.M.S. "GRIMSBY"

990 tons, 16½ knots, 2—4.7 in. guns, 1—3 in. anti-aircraft, gun. Completed 1934

Photo: Wright and Logan

advent of steam the type began to die out, until by the commencement of the present century very few of them were left. In 1914 those in the British navy numbered about a dozen, and were remarkable as being the last class of vessel to be equipped with sail as well as steam.

The progress of the World War caused an ever-increasing demand for minesweeping craft, and in 1915 the first of the "Flower" class minesweepers was laid down. These vessels came to be classified as sloops, and this classification has been retained for succeeding vessels.

At the present time the British navy has four classes of sloops. The most numerous class, of which the vessel illustrated is typical, are equipped to act as minesweepers in war, but are employed on police duties and "showing the flag" in peace time. Another class of slightly smaller but generally similar ships is used for minesweeping only. The *convoy sloops* are a larger type with a comparatively powerful gun armament; their function is to furnish escorts for convoys of merchant ships. The *coastal sloops*, which are the smallest type of all, are equipped specially for anti-submarine work.

Except in the French navy, the sloop as a type is not strongly represented in other fleets.

SLOTH, *slōth* or *sloth*. Common name of a family of animals belonging to the order Edentata (which see), which includes mammals lacking in teeth or with only rudimentary ones. The sloths move along the branches of trees upside down, and they show remarkable agility. Their hooklike claws enable them to hang securely from the branches, and they are able to sleep in this position. Sloths rarely come down to the ground, nor do they need to, for they feed on leaves,



YOUNG SLOTH

Photo: Booth Line

buds, and young shoots. They sleep by day and usually move with great caution, for they are the prey of numerous stronger animals, and are almost defenceless.

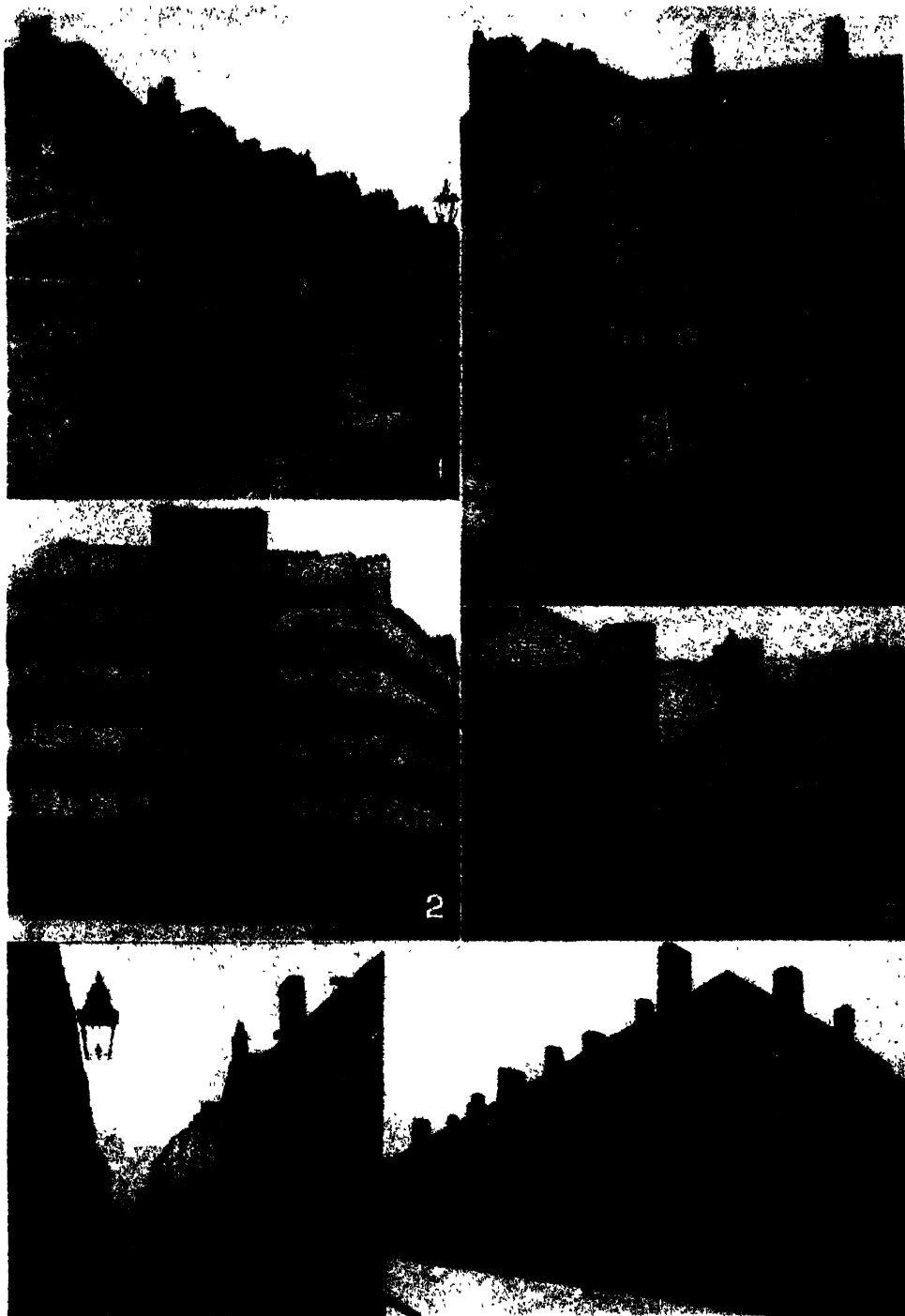
These queer animals are most grotesque in appearance, with their tailless bodies,



SOUTH AMERICAN TWO-TOED SLOTH

Photo: U. & U.

earless heads, and blunt noses. The coarse hair is of a greyish colour, which renders them inconspicuous. There are two sub-families, called by the native names of *Unau*,



SLUMS AND SLUM CLEARANCE

1. Rear view of slum dwellings on a London County Council estate which are giving place to modern flats such as those shown in Fig. 6. 2. Modern flats at Poplar. 3. Love Lane, Cardiff. 4. New flats at St. Pancras. 5. Miners' dwellings at Blairstown, Wales.

Photos: London County Council; Fox

containing sloths with two toes on the front feet, and *Ai*, including those with three toes on these feet. All are indigenous to tropical America.

Scientific Names. Sloths comprise the family *Bradypodidae*. Typical species include the two-toed sloth of Brazil, *Choloepus didactylus*; the three-toed, *Bradypus tridactylus*; and the collared, *B. infuscatus*.

SLOUGH. A modern market town of Buckinghamshire on the Great West Road, now a satellite town of London, though still retaining some ancient inns and the old church of Upton, with fine Norman doorway. It has brickfields and nursery gardens, but the rapid expansion in recent years has come chiefly with the establishment of engineering plant. The population of 33,530 (1931) has shown an increase of 65 per cent in ten years.

SLOVAKS, slô' vaks. A Slav people living in the new Czechoslovakia and in settlements in several adjoining districts. When Hungary joined Austria in the Dual Monarchy in 1867, acts were passed for the protection of the many nationalities included in the new kingdom, but they were never enforced. The treaties following the World War freed these peoples.

SLUG. A mollusc resembling the snails in structure and habits, but having a vestigial horny plate embedded in the body, instead of an external shell. Like the snails, slugs have two pairs of tentacles, on the upper and larger of which the eyes are borne. These voracious creatures excrete a slimy mucus as they crawl along, to facilitate their slow, dragging movement. Gardeners sprinkle soot about plants they wish to protect.

Scientific Name. Typical slugs belong to the genus *Limax*.

SLUMS AND SLUM CLEARANCE. There is no fixed standard of housing accommodation which decrees the property to be a slum. It is not always a small house which is overcrowded; the worst conditions are to be found in the larger houses where many rooms are let, often to as many families. Sanitary arrangements become inadequate; there is a lack of fresh air; and the continuous use of one room for sleeping and living purposes frustrates any desire to keep it clean. Slums thus become the breeding-ground for diseases. Overcrowding is bad for physical development of children and the efficiency of the workers, and the inability to segregate the sexes is morally undesirable. The evil is due primarily to a lack of adequate accommodation at a reasonable rental.

Accommodation in slum dwellings is not always at a cheap rent. Improvement in these cases is not such a difficult problem as in those where a small rent is paid and the tenants, often casual workers, are not able

to pay any more. It is disastrous to attempt to re-house the poor by taking them further away from their work and so adding to their expenses. Large towns like London have found that no land is available for housing schemes within their own boundaries, and they have been forced to develop estates outside their areas. These can relieve the slums only by accommodating those who can afford the rents and travelling expenses. Smaller towns are more fortunate in being able to re-house their slum dwellers within easy reach of their work.

Within a large city the solution seems to be to clear the slum areas (after compensation has been paid to the owners) and to build upwards in flats. Temporary rehousing of the inhabitants of the area is necessary in the first clearance, but the increased accommodation provided by the many stories of the new building solves the problem which would otherwise arise in subsequent clearances. See illustrations on p. 3983.

The tendency for factories to move out of the towns is helping to relieve one side of the overcrowding problem. See HOUSING.

SLUYS, slôis, BATTLE OF (1340). See HUNDRED YEARS WAR.

SMALLPOX. One of the most contagious diseases known. It is transmitted by germs present in the discharges of patients. Formerly, epidemics of smallpox carried off thousands of victims, but its ravages are now checked by vaccination, which is an almost certain preventive of the disease in severe form (see VACCINATION). The typical symptom is an eruption of the skin that sometimes leaves the victim with permanent scars, called pockmarks. The causal organism has not been discovered, but it is thought to be a filter-passing virus.

From ten to fourteen days after exposure, the patient feels the first symptoms—severe chill, pains in the back, limbs, and head, and nausea, with temperature rising to 103° F. or higher. On the third day, small, red pimples, which feel like bits of shot, appear on the face and spread rapidly. The temperature falls and the patient feels better. In some cases, a preliminary rash appears on the second day, but it fades away before the true eruption breaks out. On about the sixth day, the pimples fill with matter, and a depression appears in the centre of each. The temperature now rises again and remains high for about a week, accompanied by headache and sleeplessness and, in some instances, by delirium.

Treatment is directed chiefly toward keeping down the temperature, relieving pain, and preventing infection of the eyes and disfigurement of the face. Isolation of a smallpox patient is imperative.

SMELL. The sensory area for smell is a small membrane lining the roof and sides of each nasal cavity. We can only experience sensations of smell when these areas are stimulated by gaseous particles drawn into the nose by air-currents. The air-currents may be drawn in either through the nostrils, as when we breathe in through the nose, or may pass upwards into the nose from the mouth and throat. We make use of the former method in inhaling the odour of some external object, as in smelling a flower. If we are very anxious to make sure of an odour, we may sniff to get more air-currents. Air-currents passing into the nose from the mouth and throat carry the odours from substances in the mouth. Thus, to enjoy the bouquet of a wine we hold some in the mouth and breathe out slowly, through the nose. See *Nose*.

SMELT. The smelts constitute a family of valuable food fishes differing from salmon only in their smaller size and in the structure of the stomach. All but one genus are found in the northern hemisphere. Smelts live in the sea, but some species ascend rivers to spawn.

Scientific Name. *Osmerus eperlanus*.

SMELTING. See *IRON AND STEEL*.

SMETHWICK, *smeth'ik* Three miles from Birmingham is the municipal, county and Parliamentary borough of Smethwick, with a population of 84,406 (1931). It is served by the L.M.S. and G.W. railways, and is 11.6 miles from London. The chief industry of the town is engineering, but there are extensive complementary and allied industries such as the manufacture of machine tools and castings, rolling stock and stampings, bedsteads, etc., and an important metal trade. The nearness of the town to the Staffordshire and Warwickshire coalfields and to other mineral resources is, of course, a great advantage. As Smedewick the town is mentioned in the Domesday Book.

SMITH, ADAM (1723-1790). Founder of the science of economics (which see), he was born at Kirkcaldy, Fife, Scotland, and was educated at the local Grammar School, at the University of Glasgow and at Balliol College, Oxford. In 1748 he settled in Edinburgh where he gained considerable notice as a lecturer on literature and philosophy. Three years later he returned to Glasgow as Professor of Logic, succeeding soon after to the chair of Moral Philosophy. The publication of his *Theory of Moral Sentiments* in 1759, based on a course of lectures, established his reputation.

Adam Smith resigned his professorships in 1763 and toured France, where he came into close contact with the Encyclopaedists, a group of materialist philosophers.

Another important influence on Adam Smith was that of David Hume, and Smith's *Enquiry into the Wealth of Nations*, which was published in 1776, is to a considerable extent an expansion of ideas suggested by Hume's economic essays.

During his last years Adam Smith was engaged on a history of science, but only a fragment, the *History of Astronomy*, published posthumously, was completed. In 1787 he was elected Lord Rector of the University of Glasgow.

In his *Theory of Moral Sentiments* Adam Smith states his belief in the benevolent working of the universe, making more effectually for the maximum of happiness for the human race than any conscious purpose exercised through governmental or private altruism. A similar optimism runs through the *Enquiry*, and it thus forms the philosophic basis of the individualist and utilitarian creed which dominated politics and sociology for the greater part of a century.

Earlier economic writings had been concerned principally with public taxation and expenditure, hence the term "political" economy. Adam Smith prepared the way for the study of general economics, the science of wealth considered apart from the laws of political action. He separated the study also from ethics, jurisprudence and religion. But while contracting the field of enquiry he did not necessarily deny the interaction of motives belonging to these departments of human activity with those which were concerned with the creation, distribution and consumption of wealth. He denounced State interference with employers, but also condemned the acts which made combinations of workmen illegal.

The influence of *The Wealth of Nations* cannot be overestimated. Out of its teaching the Free Trade movement sprang, and it supplied a reasoned basis for *laissez-faire*.

SMITH, JOSEPH (1805-1844). The founder of the Church of Jesus Christ of Latter Day Saints, whose adherents are commonly known as the Mormons (which see). To Joseph Smith the Mormon revelation is said to have been made.

SMITH, SYDNEY (1771-1845). An English clergyman and humorist, born at Woodford,



JOSEPH SMITH
Founder of the Mormon Church.

Essex. In 1798 he removed to Edinburgh, where he engaged in preaching and tutoring; there he helped Brougham, Jeffrey, and other men of eminence to establish the *Edinburgh Review*. In 1804 he began in London a series of lectures on moral philosophy which were brought to an end in 1806, when he became rector of Foston-le-Clay in Yorkshire.

Notable among his writings are the *Letters on the Subject of the Catholics*, which helped to secure Roman Catholic emancipation. He also wrote a series of letters *On the Ecclesiastical Commission* and *On American Debts*. Smith's humor is powerful, yet always good-natured.

SMITH, WILLIAM (1769-1830). "Father of English geology"; a surveyor, engineer and geologist; born in Oxfordshire, he lived in Bath and Yorkshire. His theory of the order of the stratification of the rocks and the production of a stratigraphical map of England are his chief titles to fame.

SMOKELESS POWDER. A propellant for firing projectiles which, on combustion, does not give off smoke.

A satisfactory smokeless powder, besides yielding no solids that produce smoke, must be capable of exerting a sustained pressure on the barrel of the gun, but must not explode with too great violence.

Strictly speaking, smokeless powders are not powders, but the name is retained because they are successors of gunpowder. Practically all of them are made from

nitrated cellulose, of which gun-cotton is the most explosive form. Normally nitrated cellulose undergoes combustion too rapidly to make it a safe propellant, but it becomes of value when gelatinized or changed into a jelly-like mass by the action of some such solvent as acetane or ether-alcohol. *Indurite* is made by treating gun-cotton with nitrobenzene and hardening out the product into granules, cords, etc. Diphenylamine is also used in these processes.

SMOLLETT, TOBIAS GEORGE (1721-1771). A British novelist born near Dumbarton.

Scotland. After receiving a grammar school education, he was sent to the University of Glasgow to study medicine, and was later apprenticed to a surgeon of Glasgow. However, he was more interested in the profession of literature than in that of surgery, and by 1730 had written a tragedy, *The Regicide*. Having tried unsuccessfully



TOBIAS SMOLLETT
Photo. U. & C.

in London to secure the acceptance of this play, he embarked as surgeon's mate on the *Cumberland*, which was about to join Admiral Vernon's expedition against Cartagena (1741).

In 1748 appeared the first of Smollett's best-known works, the novel *Roderick Random*, which is a story based largely upon his experiences at sea. It became immediately popular. Of his later works, the most noteworthy are *Peregrine Pickle* and *Humphrey Clinker*.

SMUGGLING. Importing into a country dutiable merchandise without paying the duty imposed by tariff laws, or importing articles whose importation is forbidden. All countries which impose duties have stationed at their ports of entry, and at points on the borders of adjoining countries, certain officers whose duty it is to examine personal baggage and shipments of merchandise, to see that goods brought in are not under-valued, and that the regular duties levied on them are paid. In the United Kingdom the penalty for smuggling is a fine of either treble the value of the goods and duty or £100 at the option of the Commissioners of Customs, and the smuggled goods may also be forfeited to the



SEAPLANE STOPPING A DHOW NEAR PORT SUDAN

Dhows and other local craft are now stopped and searched for contraband by seaplanes which carry collapsible boats. If the boat refuses to stop, the plane's machine-gun can quickly bring down the sail.

R.A.F. Official photograph. Crown copyright reserved

Crown, together with the ship or carriage used for their conveyance. The smuggling of articles whose importation is absolutely prohibited, or permitted only under special licence, such as various dangerous drugs, may be punished by terms of imprisonment, which vary in the different cases.



AN ARMOURD SPEEDBOAT

Used to combat Chinese smugglers and pirates.

Photo: Central

Bootlegging. During the period when the manufacture, sale and transport of alcoholic liquors were prohibited in the United States by the Eighteenth Amendment to the Constitution this term was applied to the activities of those who illegally imported or supplied alcoholic liquors.

SMUTS, JAN CHRISTIAN (born 1870). A gifted Dutch lawyer, soldier, and statesman who fought with the Boers against Great Britain in the South African War, and later became one of the most trusted leaders of the empire in the Union of South Africa. He was born at Cape Town, graduated in law at Cambridge, then went to the Transvaal. Before he was thirty years old, he was State Attorney to the Transvaal Republic, under the Presidency of "Oom Paul" Kruger. In the war against Britain, Smuts rose to the rank of



GENERAL SMUTS

Photo: Photopress

general, proving himself to be as great a soldier as he had been a lawyer. He worked for the union of South African colonies, and when it was formed in 1910 he became Minister of the Interior, Mines, and Defence. When the World War began,

Smuts organized the military forces of the Union, and with Botha was given command of the expedition ordered to capture German South-west Africa; the enterprise was admirably carried through. Smuts was soon made chief of the imperial forces in South Africa, and the conquest of German East Africa was undertaken with success.

When Lloyd George formed his War Cabinet in England in 1917, Smuts became the South African representative, and he proved himself so able that he became the only permanent Dominion member of that Cabinet. In the later Peace Conference at Paris, Smuts and General Botha represented South Africa. Botha died soon after their return home, and Smuts became Prime Minister of the South African Union.

As Premier and head of the South African party, General Smuts favoured the continuance of the Union of South Africa within the British Empire, and successfully met opposition from the Nationalist and Labour parties, which advocated with more or less fervency an independent state.

SMYRNA, smur' na, or **IZMIR**. Since 1930, a vilayet and city of Turkey, situated on the western coast, on an arm of the Mediterranean Sea. The city lies about 230 miles south-west of Constantinople.

Smyrna is built on the site of a Greek colony which was in existence over seven centuries before Christ. The ancient city laid claim to being the birthplace of Homer.

The city was long famed as the centre of an Oriental rug trade. However, the struggles and hostilities for the possession of Smyrna which followed the World War reduced both its prosperity and its population. Italy had been promised Smyrna in 1917 by a secret agreement which was never ratified. Venizelos, the Greek statesman (see **VENIZELOS**), had his eye on the Smyrna territory for Greece. He represented his country at the Peace Conference, and during the period when the Italian delegates had retired because of disagreements, he succeeded in having Smyrna awarded to Greece on terms of temporary occupation. As soon as the Greek troops landed, about May, 1919, atrocities began, from which Turkish inhabitants suffered most.

In August, 1920, the Treaty of Sèvres confirmed Greek occupation. Turkey disputed the position and hostilities began.

For the first two years, Greece was successful in the campaign against the Turks. The London Conference of 1921 and the Paris Conference, 1922, attempted to deal with the situation, and the latter proposed that the area be given to Turkey, for by this time it was evident that Greece could no longer resist the Turkish arms. Though an

agreement was not reached at this time, it was the signal for many Greeks to leave Smyrna, while the Turks entered. In September, 1922, three days after the arrival of the Turks, a great fire broke out, which destroyed nearly three-fifths of the city. The Lausanne Treaty of 1923 restored Smyrna to Turkey.

Efforts are being made to revive the old-established textile industry. The carpet industry is operating at about 60 per cent of the pre-war capacity, and cotton ginneries are gradually being rebuilt; flour-milling is also on the increase. Smyrna has good railway connections, and it remains the second port in Turkey.

Population, 170,546 (1935); of the vilayet, 596,078.

SMYTH, ETHEL MARY (born 1858). English composer, born in London. She received her musical education in Leipzig, and her early compositions were performed there and elsewhere on the continent. A *Mass in D*, presented in London in 1893, attracted attention to her ability, and her reputation was assured after the appearance of her first opera, *Fantasio*, in 1898. Later operatic works were *Der Wald* and *The Wreckers*, and in the field of comic opera, *The Boatswain's Mate*. Other compositions include chamber and orchestral music, songs, and choruses. Her song *The March of the Women* was written in the cause of the suffragettes, in which she took an active interest and part. In 1922 she received the honour of being made a Dame of the British Empire.

SNAIL. A small mollusc inhabiting both land and water, and distinguished by having a spirally coiled shell attached to the soft

body (see MOLLUSCS). A snail, when it desires protection or wishes to go into winter quarters, withdraws the entire body into the shell, as the attaching membrane is a muscular process. This shell, which consists of but one valve, is secreted by the skin of the animal, and is composed of a limy sub-

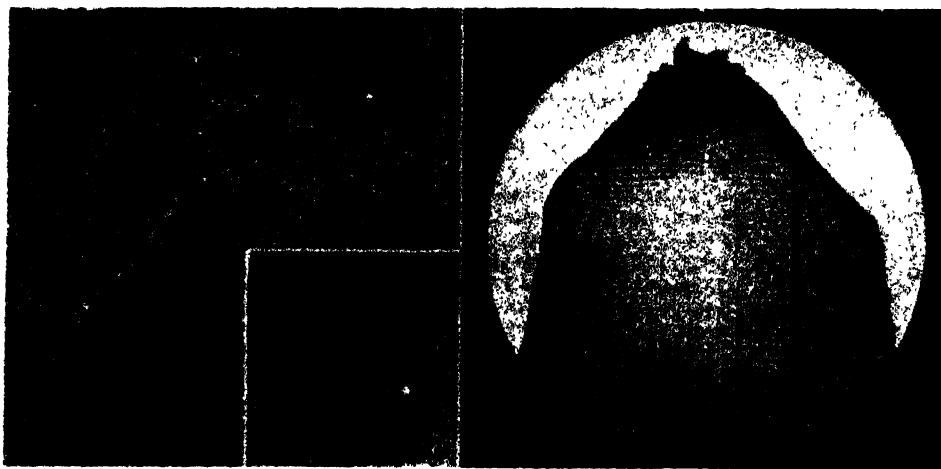


EDIBLE SNAIL

Photo: Cherry Kearton

stance. At first the shell is soft and pliable, but it becomes harder as the animal grows to maturity.

The typical land snails are found in warm, damp places in fields and woodlands. Their organ of locomotion is a foot or long, muscular projection extending from the shell. By contractions of this organ, the snail slowly crawls along, its progress being



SNAILS

Left: The slimy trail left by a snail. Centre: A snail on a leaf. Right: The palate of a snail seen under a microscope.

Photos: St. Clair, Visual Education Service

aided by the excretion of a slimy mucus. On the forward end of the foot is a head, bearing two pairs of tentacles, or horns, and on the upper pair of tentacles are the tiny black eyes, capable of seeing in all directions. The lower pair of horns constitute the organs of touch. The mouth is provided with



PARTS OF A SNAIL

(a) Eye; (b) tentacle; (c) mouth; (d) nerve ganglia; (e) foot; (f) mucous gland; (g) liver; (h) lung; (i) oesophagus. The upper illustration shows the snail in its natural position.

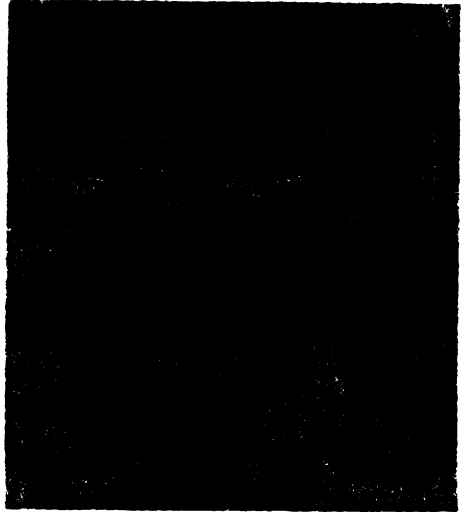
a peculiar, ribbon-like tongue, which is covered with numerous tiny, hard teeth. Though snails are fond of leaves and other vegetable matter, some are flesh-eaters.

Snails are used as food in many places in Europe, especially France. Though snail culture began near Rome about 50 B.C., it was not introduced into France until the latter part of the eighteenth century.

Water snails live in both fresh and salt water. Some of them breathe air through an opening on the back into the lung cavity; others breathe in the water by means of gills which resemble those of the oyster.

Classification. Snails belong to the class of molluscs known as *gastropods* (see GASTEROPOD). The larger and most numerous snails are found in the family *Helicidae*. The scientific name of the species eaten in Europe is *Helix pomatia*.

SNAKE. More than 1500 species of snakes are found in nearly all parts of the world, with the exception of Polar regions and most oceanic islands. There are no snakes in New Zealand, the Hawaiian Islands, the Azores, or Ireland. In the tropics these reptiles are found in greatest number.

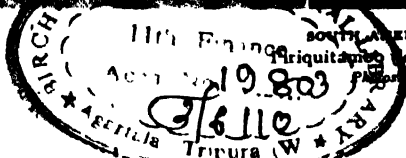
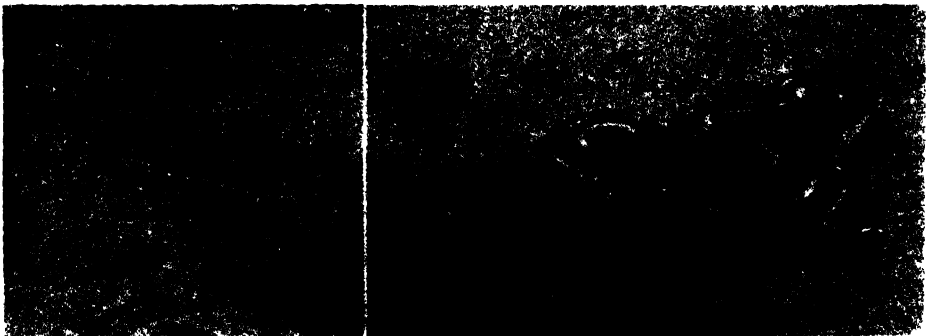


PYTHON SHEDDING ITS SKIN

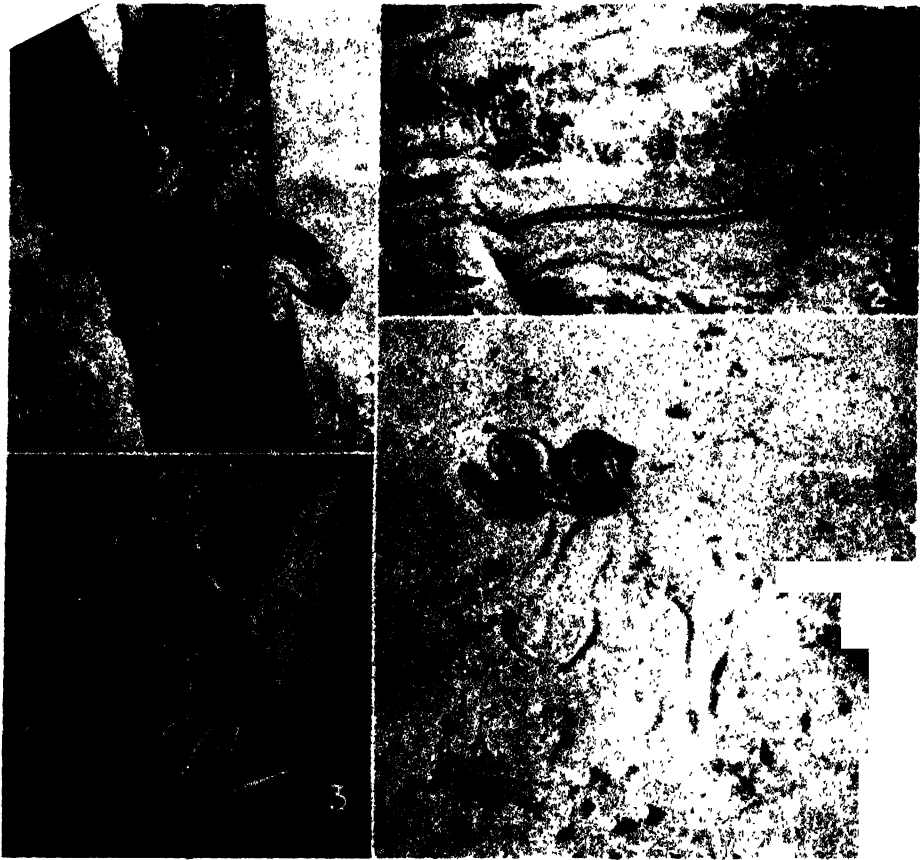
The skin can be seen on the right.

Photo: Cherry Kearton

Characteristics of Snakes. A snake, wherever found, may be recognized by the slender wormlike body that wriggles along by means of certain movements of the ribs. The snake has to get a "purchase" on the place over which it crawls, and cannot make any headway on a perfectly smooth surface. With the exception of a few species having primitive



SOUTH AMERICAN SNAKES
Briquitapies (f) and Anaconda.
Booth Line



AFRICAN SNAKES

1. Tree-climbing python. 2. Cobra about to strike. 3. Tree snake. 4. Horned Viper. This is the only snake that travels sideways—note the trail in the sand.

Photos: Cherry Kearlton

hind legs, snakes are wholly legless. The body is regularly cylindrical, and has no distinct divisions of head, trunk, and tail. Contrary to the belief of many, it is not slimy, but is covered with dry scales, which are folds in the skin. There are no external ears and no eyelids. The portion of the ear with which the snake detects sound is covered by skin and scales. In fact, some species, as the rattlesnakes, are practically deaf. The eyes are protected by a transparent cap that is shed with the skin. The tongue is long, slender, and forked—the serpent's best organ of touch—continually thrust out when the animal wishes to ascertain its whereabouts. The teeth, which curve backward, are sharp and pointed, and are used in seizing food but not for chewing, as the prey is swallowed whole. Poisonous species have, in addition to the ordinary teeth, perforated

fangs in the upper jaw, through which the poison fluid passes from glands at their base. Snakes can swallow creatures much larger than themselves, as the lower and upper jaws are hinged together in such a manner that the mouth can be widely extended. In addition, the halves of the lower jaw are connected in front by an elastic band, and each side can be pushed forward independently. As a rule, the prey is swallowed alive, but the huge pythons and boas first kill their victims by crushing them.

According to their modes of life, snakes may be divided into burrowing, ground, tree, freshwater, and sea snakes. Animal life is the chief food of snakes, but a few species eat eggs. Some snakes lay eggs, and the young are hatched outside the mother; others bring forth their young alive. The



BATTLE BETWEEN MONGOOSE AND COBRA

Photo: Cherry Kearlton



PUFF ADDER WITH THIRTY YOUNG

Photo: Cherry Kearlton

snake is in the habit of casting its skin several times a year. With surprisingly few exceptions, snakes are harmless, and even the venomous species do not usually attack human beings deliberately. On the other hand, snakes kill large numbers of rats, mice, and other crop-destroying rodents.

First Aid. In cases of snake bite, place a tourniquet around the limb above the wound, to keep the venom from flooding the system. Many hospitals have a supply of the snake serum at hand, and a doctor can obtain it in a very short while. This is the surest remedy for the dangerous venom.

Classification. Snakes belong to the class *Reptilia*, order *Squamata*, suborder *Ophidia*.

SNAKE BIRD. See DARTER.

SNAPDRAGON, OR ANTIRRHINUM. There are two varieties of this plant, though it is certain that the more showy variety, the great snapdragon, is only an escape from gardens. The other, the corn snapdragon, may be a wild variety native to Britain. The



SNAPDRAGON

Photo: Visual Education Service

large flowers of the former are of many colours, but usually deep red. The corolla of five united petals is long, tube-shaped, and split at its end so that it separates to form an upper and lower lip. The flowers are in a spike at the ends of the stems. Those of the corn snapdragon are purplish

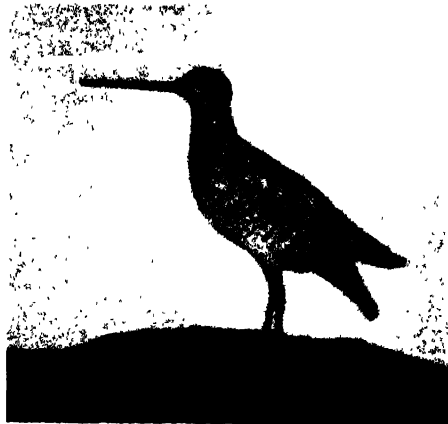
and of insignificant size. The many garden kinds are easily propagated by cuttings.

Scientific Name. The great snapdragon is *Antirrhinum majus* in the family, *Scrophulariaceae*.

SNEEZING. An involuntary convulsion caused by irritation of the sensory nerves of the nose. The act itself is a sudden and violent expiration, chiefly or wholly through the nose. It is an example of reflex action (which see), and is a spontaneous effort on the part of the body to remove the irritating agent.

Ordinary cold in the head is usually accompanied by sneezing, and continued and violent attacks are characteristic of hay fever, asthma, and nasal catarrh. Dust, pollen, tobacco smoke, and other outside irritants may cause sneezing. Local applications of menthol or a similar drug to the mucous membranes of the nose will usually allay severe sneezing.

SNIFE. The name of a group of shore birds related to the sandpipers, curlews, and



SNIFE

Photo: Visual Education Service

certain other water fowl. It is a bird dear to hunters, both on account of its fine flavour and because its erratic flight taxes their skill. The bird is acrobatic in the air, and has a strange habit of "bleating" or "drumming," a sound that it produces by mounting to a great height and then descending by one quick swoop after another, with the air rushing through its wings. The snipe is more timid than the sandpiper about being seen in the open by day. Its nest is a depression in the ground on the edge of marshes. The eggs are four in number, and their colour is olive-brown or greyish-drab, thickly spotted with chocolate. The bird is about 11 in. long, and has a short tail and a very long bill; a

flexible, sensitive tip on the latter is used skilfully in probing for worms and grubs, which are its food. The one species found in North America is the *Wilson's snipe*.

Scientific Name. Snipes belong to the family *Scolopacidae*. The common snipe of Europe is *Gallinago gallinago*.

SNOW. The crystalline form in which the surplus water vapour in the air is deposited when the temperature is lowered below freezing point. It may fall as individual crystals in very cold air where the supply of vapour is small, or in large flakes which are agglomerations of crystals where the temperature is higher. Snow in the upper strata of the atmosphere may descend through warmer layers and fall as rain. Thus, in winter, high ground receives snow and lower ground rain. Hail, on the other hand, is frozen rain. Snow crystals take various forms of stars, plates and prisms among which hexagonal arrangements are general. The white colour of snow is due to the reflection of light from the facets of the crystal. Fresh fallen snow, as a rule, is light and porous, but in time, if melting does not occur, the snow cover becomes compact and denser by both compression and regelation. Thus, sooner or later, a *névé* is formed, and in time a more or less solid covering of ice which, flowing under the action of gravity, spreads beyond the gathering-ground in the form of glaciers.

Snow is the only form of precipitation in Antarctic regions, the usual form in the Arctic, and the winter form in temperate regions. Over some two-thirds of the earth's surface snow never falls except on lofty mountain tops. The "snow line" is a term which defines the level above which snow lies all the year round, in contrast to the winter level. It varies chiefly with latitude but depends also on exposure and relief, being lower on slopes turned away from the sun than on opposite slopes, and higher on steep precipitous slopes than on gentle gradients. Owing to their mass, glaciers generally descend below the snow line. In Antarctic regions the snow line reaches practically to sea level: in Arctic regions it is rarely below about 600 ft., and in the tropics it lies at about 16,000 to 19,000 ft.

Snow has important geographical effects, among which are the flooding of rivers in spring and summer, the protection of the ground and vegetation from hard frost, the obliteration of grazing grounds, the retardation of spring growth by the saturation of the soil with cold water, and the interference with communication and transport.

SNOWBALL TREE. See GUELDER ROSE.

SNOWDEN OF ICKORNSHAW, RIGHT HON. PHILIP, VISCOUNT (born 1864). British statesman. Of humble but intelligent par-

entage, and reared in a Radical atmosphere, Philip Snowden started work at the age of twelve as a pupil teacher. Later he entered the Civil Service in the Inland Revenue Department, but after a few years was retired owing to an accident which made him a cripple. He was then caught up in the Socialist movement, which absorbed his interest and activities for the rest of his life. He wrote and lectured for the newly formed Independent Labour Party and spent ten years wholly engaged in propaganda. In 1898 he became a member of the Council of the Independent Labour Party, and in 1906 entered Parliament as member for Blackburn, winning a seat which he held until, in consequence of his pacifist views, he was defeated in the post-War election of 1918.

After an interval of four years, Snowden re-entered Parliament as member for Colne Valley, and when Labour attained to office in 1924 he was appointed Chancellor of the Exchequer. He introduced the first Labour budget, by which the McKenna Duties (first imposed in 1915) were repealed, the Entertainment Tax reduced, and progress made towards the ideal of a "free breakfast table" by the halving of the duties on tea and sugar. Again in 1929 Mr. Snowden was at the Treasury and in the same year he won great popularity by the strong line he took at the Hague Conference in defence of British interests.

The financial crisis of 1931 hastened the fall of the Labour Government, and when in the autumn of 1931 the storm broke and a National Government was formed, Mr. Snowden, though with misgivings, joined the Coalition. He brought in an emergency budget in September, making drastic economies. It was received with great enthusiasm in the House of Commons, notwithstanding the disagreeable necessity which had given rise to it.

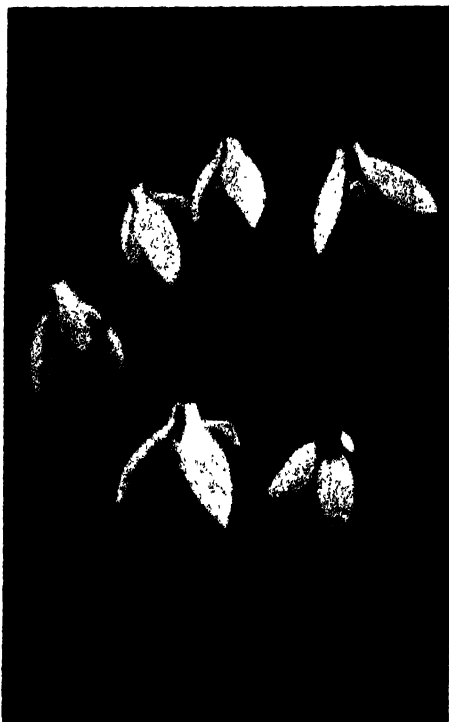
In the same year, Mr. Snowden resigned his seat in the Commons and soon after he was elevated to the peerage. He was still a member of the Government, but in 1932 resigned with the other Free Trade ministers on account of disagreement with the Report of the Ottawa Conference.

SNOWDON, MOUNT. See WALES.



LORD SNOWDEN
Photo: Fox

SNOWDROP. Any one of a genus of flowering plants of the amaryllis family, so named because they bear delicate white blossoms which are sometimes in flower when the snow is on the ground. The common snowdrop of the gardens is one of the hardiest of out-of-door plants. The snowdrop grows from a small, bulbous root, from which spring two or three narrow green leaves and a leafless flower stalk. The nod-



SNOWDROPS
Photo. Carters

ding, bell-shaped flowers grow singly at the top of the stalk, and usually come into blossom in northern climes in February or March. The plant is easily cultivated, for the bulbs can be planted in a sheltered place and be left to themselves. See AMARYLLIS FAMILY.

Scientific Name. The botanical name of the common snowdrop is *Galanthus nivalis*. The family is Amaryllidaceae.

SNOWSHOE. A contrivance to aid in walking on snow, consisting of a light wooden frame bent in an elongated oval, across which is stretched a web made of deerskin thongs, strung much like a tennis racket. The snowshoe is provided with supports and holders for the feet. The

principle applied is that of distributing the weight of the body over a considerable area,



PARTS OF A SNOWSHOE

(a, a) Frame, or bow; (b) heel filling; (c) centre filling; (d) toe stays; (e, e) crossbars; (f, f) lanyard; (g) tail; (h) toe cord; (i) toe hole; (j) toe filling.

thus enabling the yielding surface of the snow to support it.

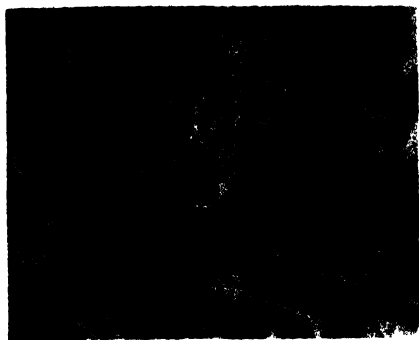
SNUFF. A fine powder made from the stems and leaves of the tobacco plant, which have been fermented by heat and moisture, then dried and ground. Snuff is inhaled through the nostrils or rubbed on the gums. Various mixtures of flavours or scents are added to make the powder pleasant for



AFRICAN SNUFF-TAKER
Photo: Cherry Kearton

inhaling. Formerly, it was considered a matter of etiquette to offer "a pinch of snuff" to friends whom one met.

The habit of taking snuff causes irritation of the nerves of smell and deterioration of ability to distinguish odours.



AFRICAN SNUFF-SELLERS

The snuff is carried in hollowed wood.

Photo: Cherry Kearton

SOAP. A manufactured product which is an indispensable aid to cleanliness. Its ingredients are very largely fats and oils, including marine oils, palm kernel oil and ground-nut oil, lard oil, palm oil, olive oil, cotton-seed oil, coconut oil, corn oil, stearin, and crude oleic acid. Tallow is too expensive for general use. Two varieties are commonly known—hard soap and soft soap. That which contains a potassium treatment in the making is soft soap; the hard variety is a sodium compound.

Our great-grandmothers saved greasy substances from their kitchens, to be boiled down and treated with lye which they distilled from wood ashes. Their soap was yellow because of the potash in the lye. The housewife knew how to continue the process and produce hard soap, by using brine, which is salt in solution. The potassium in the soft soap was thus replaced by the sodium in the brine; the part that was soap rose to the top of the receptacle.

Soap Manufacture. Resin, or laundry, soaps are made from mixed batches of animal and vegetable oils. In the course of the manufacturing process, resin is added to give the soap its characteristic yellow colour. The fatty material, known technically as *stock*, is poured in a liquid state into a sheet-iron kettle heated by steam coils. During the heating process, lye is added to the mixture from time to time, and when the contents have the appearance of a thick gum, saturated salt solution is added until the soap floats on the surface. The mixture is then cooled, and in this process the brine sinks to the bottom of the kettle. The brine is then drawn off and worked for glycerine and salt, while to the soapy layer fresh strong lye and resin are added. The resulting mixture is heated until the resin is thoroughly united with the soap. Then a salt solution

is added as before; the lye is drawn off; fresh, strong lye added; and the mass boiled again. After further cooling, settling, and reheating, and the addition of cold water, the contents of the kettle are allowed to cool off slowly to a temperature of 65° C.

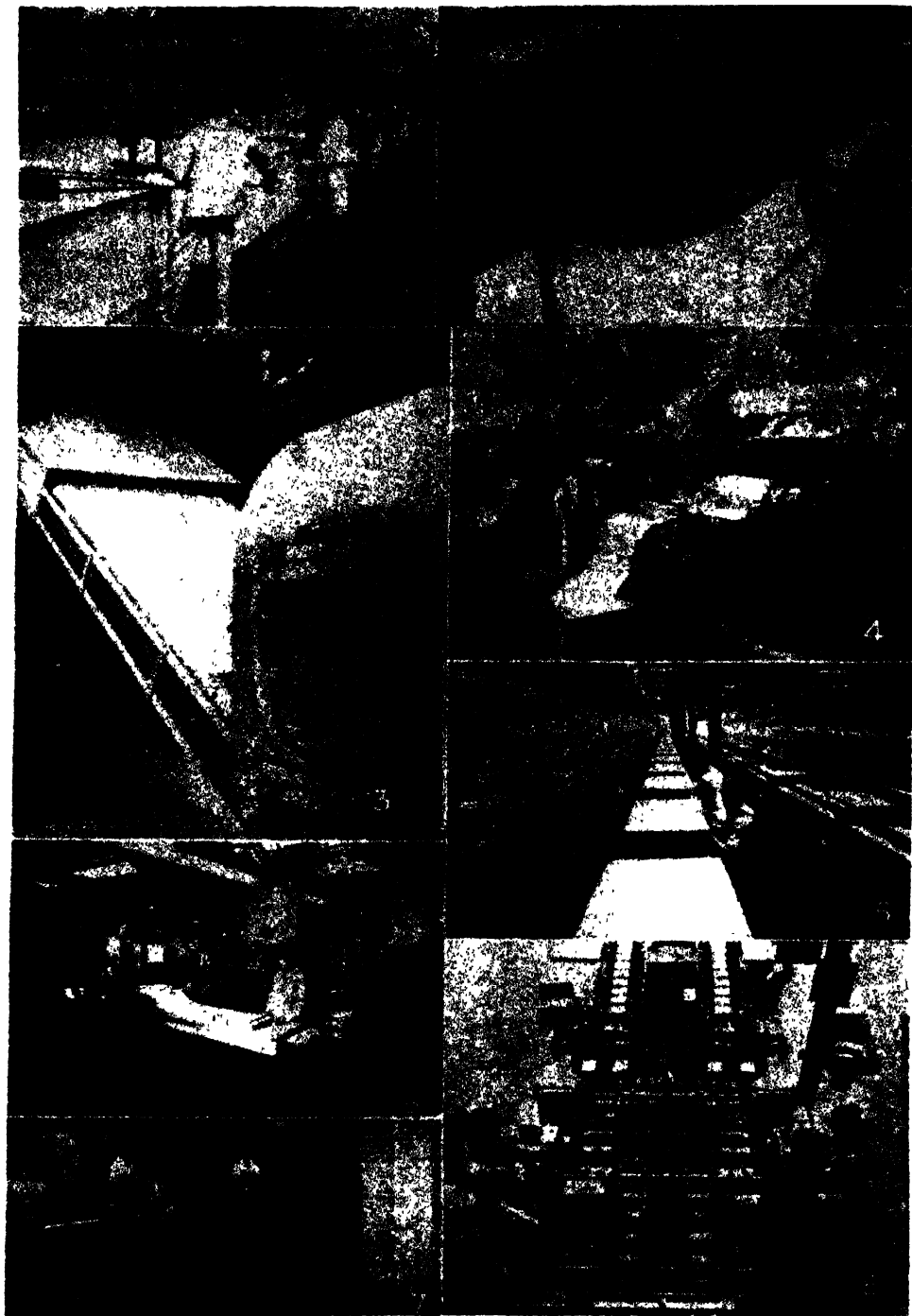
The soap is next run into a horizontal revolving cylinder known as the *crutcher*, in which it is stirred until the mixture is of a uniform colour and texture. Chemicals, such as carbonate of soda, are sometimes added to improve the quality. Finally, the mixture is run into moulds, where it is allowed to harden into huge cakes. These are cut into bars by steel wires and wrapped by machinery. See illustrations on next page.

Toilet soaps require several other processes, but the crutching operation is omitted. These soaps are usually scented and coloured. Alcohol is used in the manufacture of transparent soaps, but is distilled off and recovered from the completed product. Floating soap is contrived by aeration. Sailors use what is known as *salt-water* soap, made from coconut oil, potash, soda lye, and salt. The popular Castile soap is made from olive oil and soda or mixed potash.

SOBIESKI, *so' byes' hi*, JOHN. See JOHN III OF POLAND.

SOCIALISM, *so shul iz'm*. A social doctrine and at the same time a political movement. In the vague sense in which the term is often employed it means anything which tends to abolish or to mitigate economic inequality. In its more exact sense it denotes the ideal of a society in which private property is replaced by public property, in so far as the means of production (factories, land, mines, etc.) are concerned. Even this definition leaves room for doubt, since the term "public property" comprises a number of possibilities, and the means of production may belong to the State, to municipalities, to guilds or to other corporations. In fact all these different forms of public property have been advocated by Socialists. The chief point, however, is that according to the socialist ideal the means of production are no longer at the disposal of private individuals for the promotion of profits, but are at the service of the community for the satisfaction of common needs. Socialism therefore approaches social and political questions from a collectivist point of view and tends to disregard individual rights, though it claims to secure individual liberty ultimately better than any other social organization.

In their final aim (the abolition of the private ownership of the means of production) Socialism and Communism are indistinguishable and indeed were for a long time synonymous terms. The two theories,



SOAP MANUFACTURE

1. General view of the pan-room at Port Sunlight where oils and fats are boiled together. 2. A close view of oils and fats boiling in a steel pan. 3. Drying boiled toilet soap before the milling process. 4. Milling toilet soap. 5. Soap cooling in the frame room. 6. Stamping bar soap mechanically. 7. Packing soap tablets into cartons. 8. Close-up of a stamping and wrapping machine.

Photos: Lever Brothers Ltd.; John Knight Ltd.

however, have diverged fundamentally, for Socialists believe that Socialism can be brought about by a constitutional struggle for power in a democratic state, since it would benefit the greater part of the electorate, whereas the Communists wish to establish the dictatorship of the proletariat. In fact, since 1900, socialist parties have collaborated in many governments of the world, and have thus endeavoured to raise the standard of the working classes by availing themselves of democratic methods instead of preparing for a violent revolution.

Socialist ideas are to be found in all ages. The desire to organize society on collectivist lines is one of the strongest forces in the social history of man. Plato was the first great political thinker to give expression to this desire. In his *Republic* he raises such demands as community of property, at least for the class which is destined to rule his ideal state. These ideas, however, had no direct influence on social life, which remained marked by its rigid class distinctions. Socialist tendencies first gained ground in connection with the social movement which accompanied the expansion of Christianity. The Christian teaching appealed to the poor, and the vast class of slaves seized on a doctrine which taught them that wealth was not the proper goal of man. Yet early Christian doctrine cannot be considered truly socialist since it was primarily concerned with the next world, though it is noteworthy that the early Christian communities had many socialist features.

All socialist movements of the Middle Ages were, in the first place, of a religious and sectarian character and were often in violent conflict with the property-owning Church. Such movements were those of the Manichaeans in the eleventh century, the Apostles about 1300, the Lollards in the fourteenth century and the Anabaptists in the sixteenth century. In the fourteenth century in England and France and in the sixteenth century in Germany (Peasant War) we find social upheavals which were abortive socialist revolutions. On the whole, however, medieval social movements led only to isolated struggles between journeymen and their masters or peasants and their lords, and to local strikes in economically advanced districts such as Flanders or Northern Italy. Thomas More, though he wrote at the end of the Middle Ages, outlined in the most famous of all "utopias" the modern ideal of a socialist commonwealth, which was to have an incalculable influence on all later socialist thought.

The great European movement of the seventeenth and eighteenth centuries, which proclaimed the supremacy of reason, gave

a new stimulus to socialist ideas. Thinkers such as Rousseau, Mably and Morelli in France, questioned the reasonableness of the established social order. The French Revolutionary thinkers, who owed much to Rousseau, were however primarily concerned with the struggle against feudalism (which see) and clung to the principle of private property. Only G. Babeuf (1760-1797) was a genuine socialist, who attempted to give the Revolution a socialist basis, but he was defeated.

Socialism as a Political Movement. It was under the influence of the Industrial Revolution that socialism first gathered strength. The invention of machines increased the economic output, and the rapid expansion of production created a vast class of workers who possessed nothing but their working power and who were to form the armies of the socialist movement. It was, however, not from the side of the workers but from that of humanitarian intellectuals that socialist ideas first achieved expression. Like many important movements, socialism started as a Utopian dream of thinkers who were dissatisfied with existing conditions. The Industrial Revolution started in England, and it was natural that socialist tendencies should make themselves first felt in the country which experienced all the horrors of early factory labour, including the employment of children. It was a humanitarian employer, Robert Owen, who was one of the first to attempt a reform of the social system. In the hope of introducing socialism by private enterprise, he established self-supporting communities on communist lines, which, however, failed since they were isolated in an unchanged society. Owen's importance lies in the stimulus which he gave to trade unionism and to the co-operative movement. The Chartists (1838 to 1850), though they were radical democrats rather than socialists, organized the first working-class movement of importance in England (first general strike).

In France, Saint-Simon (1760-1825) and his disciples stressed the fact that there was a class of exploiters and one of exploited, and they tried to reconstruct society on the assumption that the workers ought to control the State. They demanded the socialization of the banks and the abolition of private property. Thinkers such as M. C. Fourier (1772-1837), Joseph Proudhon (1809-1865) and Louis Blanc (1811-1882) were all keenly aware of social injustice and used strong expressions against the possessing classes. Proudhon coined the slogan "Property is robbery." Fourier advocated the foundation of self-supporting communities with the help of the State, which would then force private employers to conform to their

standards. Louis Blanc hoped to overcome unemployment by the creation of public workshops, maintained by the State and designed to organize production. All these thinkers were members of the middle class; their ideas were to a large extent Utopian, and their chief importance lies in their insistence on a scientific study of social problems.

It was against these thinkers that Marx turned when he derided Utopian socialism and claimed that he had worked out a scientific socialist doctrine. Marx's own doctrine, certainly, attempted to analyse the mechanism of capitalist society and tried to prove that capitalism would ultimately lead to a socialist revolution. It is perhaps a serious weakness of Marx's doctrine that he was more concerned with analysis than with construction.

Modern Movements. Socialism first organized itself effectively among the working class in Germany. F. Lassalle founded the Universal German Workers' Union in 1863 and in 1864 the First International was founded in Brussels and London. In the meantime the writings of Marx and Engels had influenced continental socialists, and the formation of the International shows that Marx's teaching had been accepted according to which socialism was a class movement transcending national frontiers. In 1869, the German Democratic Party was founded in Eisenach, which superseded Lassalle's organization and played an important part in German politics until it was dissolved by the National Socialists in 1933. The First International, however, was not a success since the socialist movements outside Germany were too weak, and it was not until 1889, when the Second International was founded in Paris, that there existed an efficient socialist organization on an international basis. This Second International was renewed in 1923 in Hamburg and is still in existence.

Although Marx spent most of his life in England, his influence there remained for a long time negligible. Owing to the growing prosperity after the repeal of the Corn Laws, there was no socialist movement in England. In 1881 H. M. Hyndman, who had read Marx's writings, founded the Democratic Federation (since 1884 the Social Democratic Federation). This organization carried out an active propaganda which led occasionally to disturbances, as on 13th November, 1887, in Trafalgar Square (Bloody Sunday). The movement found many sympathizers among the intellectuals, particularly after William Morris joined it in 1883. In 1884 the Fabian Society was founded (G. B. Shaw, S. and B. Webb, Annie Besant, and others), which was

more influenced by Henry George than by Marx. The British socialist movement, organized in the Labour Party (which see), remained comparatively free from continental influence and adapted its doctrines to particular English needs. Lately, however, Marxian tendencies have made themselves felt more strongly, as for instance in the Socialist League, an organization inside the Labour Party.

In France the disaster of the Franco-German War produced a communist upheaval in the Commune of 1871, which failed, since the French middle classes resented radical experiments. Socialism in France remained disunited until 1905, when the United Socialist Party was founded. Jean Jaurès was its most famous leader till 1914. Socialist tendencies found expression outside the party in the syndicalist movement, which advocated a struggle for socialism through the Trade Unions by means of strikes and sabotage.

Other European socialist parties were founded in Belgium (1885) under Vandervelde, in Italy (1882, 1892), in Holland (1894) under Troelstra, in Norway (1897), in Austria (1886) under Victor Adler, in Poland (1890) under Pilsudski, in Sweden (1890), in Switzerland (1888) and in Spain (1879). Spain is the only European country in which the anarchists have played an important part, whereas all other working-class movements have repudiated anarchism. Bakunin, the most famous anarchist, was expelled in 1872 from the First International. The socialist party of America was founded in 1901 (Farmers' Labor Party in 1919), but socialism in America is still of little importance. The only country which has no socialist movement at all is Ireland.

In international politics the socialist parties stand for peaceful co-operation and disarmament. The World War proved a serious setback to socialism, since the different parties rallied to the support of their governments and thus revealed the fact that the international solidarity of the working classes was limited. There is no doubt that socialism at present is in a state of ferment, and in many countries is on the defensive. But although the socialist parties have lost ground, yet socialist ideas are to an increasing extent shaping modern political life.

See also ANARCHY; COMMUNISM; INDEPENDENT LABOUR PARTY; LABOUR PARTY; MARX.

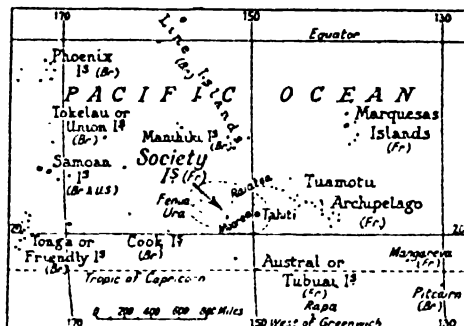
SOCIAL PRECEDENCE, *pre se' dens*. From the earliest days of an ordered civilization, there have been individuals, castes, or classes of society that have assumed, or have been granted, precedence over others in social affairs. Precedence means priority of

place, or superiority, in the conventional system of arrangement under which the more eminent and dignified orders of the community are classified on occasions of public ceremony and in the intercourse of private life.

In Great Britain, the order of precedence is well established and closely observed. The sovereign and his immediate relatives take precedence over all others, and in the following order: the sovereign, the Prince of Wales, followed by the younger sons and the sovereign's brothers, uncles and nephews. Then follow the ambassadors, the Archbishop of Canterbury, the Lord High Chancellor, the Archbishop of York, the Prime Minister, the Lord President of the Council, Lord Privy Seal, and the Speaker of the House of Commons, in the order named, followed by dukes, marquesses, earls, viscounts, bishops, secretaries of state (if barons), barons, certain officers of the royal household, secretaries of state (below the degree of baron), Knights of the Garter, Privy Counsellors, Chancellor of the Exchequer, Chancellor of the Duchy of Lancaster, the Lord Chief Justice, the Master of the Rolls, Lord Justices of Appeal, Judges of the High Court, baronets, knights, County Court judges, companions, members and officers of Orders, and gentlemen entitled to bear arms. The sons of peers, baronets, etc., also have their stated order of precedence, and the five state officers (if dukes)—the Lord Great Chamberlain, the Earl Marshal, the Lord Steward, the Lord Chamberlain and the Master of the Horse rank after the Lord Privy Seal. Women take the same rank as their husbands or as their eldest brothers; but merely official rank on the husband's part does not give any similar precedence to the wife. In cases of local precedence, as in a county or city, there is no official list.

SOCIETY ISLANDS. A French possession in the Pacific Ocean, lying some 15° to 17° south of the equator. They comprise Tahiti (600 sq. miles), the Iles du Vent, with Moorea of 50 sq. miles and the smaller islands known as the Iles sous le Vent. The islands are volcanic and lofty and surrounded with coral reefs. Tahiti rises to 7337 ft. and Moorea to 3975 ft. The climate is warm with much rain, and violent hurricanes occur. Fertile conditions prevail and there is much forest. The population, which is chiefly Polynesian, numbers about 20,000, of whom 16,700 live on Tahiti. The total includes some 4000 Chinese and about 5000 French people. Many tropical crops, including bananas and other fruits, are grown for local use. The conditions are suitable also for cotton, sugar, cocoa and tobacco, but the coconut is

the chief commercial crop and copra the chief export. Vanilla is of some importance. The natives use much fish and pearl shell is exported. There is a little sugar refining and rum distilling. The capital is Papeete on Tahiti with a population of 4848 French and 2213 natives. All external communications go through Papeete. The Society Islands were certainly discovered by early Spanish



navigators and possibly by Quiros in 1606. Various Spanish, British and French claims ensued before the islands were declared a French Protectorate in 1842, and after some resistance the Tahitians accepted French rule five years later. Papeete is now the seat of the governor and administrative council of the French Establishment in Oceania.

SOCIETY OF FRIENDS. Actual name of the religious body generally known as QUAKERS (which see).

SOCIOLOGY. *so shi ol' o ji.* The study of the human race, including its history, evolution, present condition, and probable future, the laws which govern its development, and the place of the individual in relation to society. The scope of sociology is necessarily broad. History, ethnology, civics, economics, anthropology, ethics, psychology, philosophy, and, above all, biology—all the sciences which treat of human beings and the conditions under which they live—are related to and contribute to sociology. This science rests on the assumption that all human experience depends on three things; the physical conditions under which life is maintained, the relation of the individual to other individuals and to society, and the types of association in which individuals influence each other. Before it can begin its research, sociology must have data on all these subjects, and so it goes for its statistical side to the other social sciences. With the data which he gathers from every source, the sociologist endeavours to fix the laws and conditions of the reactions between nature and human beings, both as individuals and in the group.

Other sciences—physics, chemistry, mathematics—rest on relatively unchanging, invariable laws. These sciences have reached the stage of development at which the ordinary phenomena of everyday life pertaining to them have been thoroughly investigated and generalized into definite and exact laws and formulas. Isidore Auguste Comte, when he first outlined the field of sociology and gave it its name, held that it, too, might be an exact and invariable science; but human behaviour is much more complex than physical phenomena, and has not yet been so completely studied or so accurately and definitely generalized. Biology, the study of all life, is the great foundation for the study of human life, and biology is even now in an unfinished state. Psychology, which studies the behaviour of the human organism in its psychic contacts with its environment, is even less of a developed science.

Important as is the biological heredity of the individual, his social heritage, although interlocked with the biological, forms the essential subject-matter of sociology, and demands observational and scientific study of its origin and development.

The five chief classes in the formal study of sociology—each class, in turn, is divided and subdivided—are (1) *descriptive sociology*, which includes all the preliminary work of stating observed phenomena; (2) *social psychology*, which covers the study of the growth of personality and the behaviour of groups; (3) *social ethics*, which studies the social consequences of behaviour, criticizes traditional theories and canons of social policy, and defines social objectives; (4) *social technology*, the application of known social facts and principles to the bettering of social conditions; and (5) *social investigation*, which applies scientific methods to the study of social phenomena and the formulation of sociological principles and laws.

APPLIED SOCIOLOGY

A sociologist investigates the behaviour of men in groups. As an engineer maps a region to find the best line for a road, social workers now examine a community to discover what can be done to improve it. This system of plotting conditions is called *the social survey*.

Gathering and Measuring Facts. During the last decade of the nineteenth century, Charles Booth directed an investigation of living conditions in London, which showed that nearly 31 per cent of the people in that city were in poverty. Since then, similar explorations of neglected corners of community life have been made. Such field work has yielded a mass of informa-

tion about the conduct of men in groups, and has tested definite ways of gathering this knowledge.

When we have found a number of facts, the next step is to arrange and measure them. In order to clean out a city slum, we need to know exactly how many tenements must be pulled down, the number and kinds of people to be lodged elsewhere, and how much the moving will cost. This requires counting, classifying, and calculating definite amounts. So in studying human groups, sociology now uses precise mathematical statements, wherever this is possible.

Investigating Living Standards. Although measuring wages and prices is primarily a task for economists, determining a reasonable standard of living concerns sociologists. During the third quarter of the last century, Frederick Le Play gathered data upon working men's budgets in Europe, as also did Rowntree in England. Since then, many studies have been made by public and private agencies, to find what level of health, comfort, and security is required by workers. Minimum-wage commissions in several countries have fixed basic rates of pay, established by conditions in their communities and by the nature of the businesses concerned.

Many other social agencies, such as insurance and pension bureaux, require exact information about the number of people and the amounts of money involved. Every reputable welfare institution is expected to publish a report showing the extent of its work and the disbursement of its funds. Such reports enable students of society to understand the size, character, and treatment of such problems as poverty, disease, and crime.

Grand totals and averages tell little about individual cases. To understand the causes and personal consequences of general conditions, we must investigate the histories of representative men and women from various social classes. The method of tracing the development of individual characteristics is much like that of a physician in studying the course of disease in a patient. For this reason, it is called *the case method*.

The Case Method. The charity organization movement, which originated in London in 1868, emphasized, as one of its principles, careful investigation and registration of all applicants for aid. The records of modern relief societies have spaces for entering important items concerning the history and connections of every family treated. From such information, the co-operating agencies are supposed to outline a plan of treatment.

One of the most interesting recent developments of case work is the application of

methods used by psychologists to discover the causes of mental disturbances. These are frequently found to spring from unfortunate experiences in early childhood, or from worries attendant upon bad living conditions. From studying the background of juvenile delinquents, there has been gathered a store of knowledge helpful to the guidance of parents and teachers. Juvenile courts now include persons trained in this field.

Transition from Relief to Reconstruction. In tracing the causes of social ills, it has been found that cases of poverty, disease, and crime are often merely the result of bad conditions in the community. Moreover, these conditions are permitted to exist because many people assume that they cannot be changed. Thus, poverty and disease are believed to be necessary evils. Modern social workers do not support this opinion. They admit that alms and medicine are necessary for those who suffer from past misfortune and neglect, but they also try to remove the conditions that produce poverty and sickness.

The Minority Report on the English Poor Law (1909) is a striking example of this change. The report makes plain the fact that not all poor people are dependent for the same reasons. It recommends that children be educated, that sick people be treated by the health authorities, that the unemployed be assisted to find work, and that the aged be granted pensions. This programme calls for constructive efforts by public authorities, instead of doles. Agencies dealing with delinquents now consider reformatory treatment and means for wholesome recreation, as well as punishment and prison discipline.

The advance in this respect came soon in Britain, but it is only now that America is endeavouring to wipe out the arrears of twenty years. Labour exchanges, unemployment insurance, sickness benefit, old age pensions, all these are necessary to the organized state to-day.

As knowledge of underlying conditions has grown, social workers have come to see that many local difficulties are merely evidences of widespread disorder. State and national organizations have been formed to meet these general situations. In some cases, it has been found necessary to make international agreements, in order to compass all the factors. For instance, international conferences are held to check the manufacture of morphine in England and to limit the growth of poppies in Persia

in order to decrease the consumption of opium throughout the world. The same principle applies to the use of alcohol, and other international problems considered by the League of Nations.

SOCRATES, *sok' ra leez* (467-399 B.C.). A Greek philosopher, born in Athens. He received only a meagre education in his youth, but later became familiar with the best philosophy and thought of the period. For a time his career was that of sculptor. From 432 to 429 B.C., he was in military service; he fought at Delium in 424 and at Amphipolis in 422, but refused to take further part in public affairs after the naval Battle of Arginusae, when the mob unjustly demanded the death of ten generals who had been unable to bury the dead.

As a teacher, Socrates was not popular among the citizens of Athens. His personal



A BUST OF SOCRATES
Photo: Visual Education Service



THE PRISON OF SOCRATES AT ATHENS
Photo: Visual Education Service

appearance was against him, for he was bald, had thick lips, a flat nose, ungainly figure, and beggarly costume. His wife Xanthippe

has passed into tradition as a scolding, arrant shrew.

He had many illustrious friends, but his chief work was among the Athenian youths, whom he felt called upon to conduct through love to a nobler moral life. Self-knowledge was his ideal; "Know thyself," his maxim. To him wickedness was the result of ignorance. The good, the useful, and the beautiful were declared by him to be identical. No man is willingly bad, he argued, and love of virtue can be taught. The best rulers are those who are wisest, not necessarily the best educated, for they will most readily know how to make the people happy.

His method, known as the Socratic, became famous throughout the Mediterranean countries. It was an art of cross-examination which lured even the wisest into contradictions. He veiled his own knowledge behind a professed ignorance, and by a series of carefully directed questions brought out from his hearers the truth he sought. He is most closely identified with the Theory of Ideas, which maintains that each kind of material entity is only the phenomenal "copy" of a metaphysical reality. His philosophy has been perpetuated in the writings of his disciple Plato.

In 399 B.C. Socrates was condemned to death, because he had introduced new gods and failed to worship the city divinities, and because, it was charged, he had corrupted the youth.

SODA. The general name of several sodium compounds occurring in nature in natural alkaline waters. The term *soda* is employed more commonly, however, to designate certain commercial compounds used in the household and in industry. The sodas of commerce are manufactured by various processes from common salt. One kind, known in chemistry as *sodium carbonate*, is employed in the manufacture of glass and soap, as a disinfectant, and as a cleansing agent. Sodium carbonate is commonly known as *washing soda*. *Sodium bicarbonate* is the common *baking soda* used with sour milk or cream of tartar to raise bread, biscuits, or pastry. It is also an ingredient of baking powder. When heated or when mixed with an acid, sodium bicarbonate gives up carbon dioxide, and the escaping gas puffs up the dough. Sodium bicarbonate is used in medicinal preparations for the relief of acidity of the stomach. *Caustic soda*, known as *sodium hydroxide*, is used in making hard soap, paper, and dyestuffs, and in bleaching and kerosene-oil refining. See CAUSTIC SODIUM.

Chemical Formulas. The formula for sodium carbonate is Na_2CO_3 ; that is, a molecule contains two atoms of sodium (*natrium* in Latin), one atom of

carbon, and three atoms of oxygen. Sodium bicarbonate is NaHCO_3 , its molecule containing one atom of sodium, one of hydrogen, one of carbon, and three atoms of oxygen. Sodium hydroxide is NaOH ; its molecule contains one atom of sodium and the hydroxyl group OH. The latter is an association of one atom each of oxygen and hydrogen, the atoms remaining together in chemical reactions.

SODA WATER. See CARBONIC-ACID GAS; MINERAL WATERS.

SODIUM. A silvery-white metal that is soft as wax and lighter than water. Its symbol is *Na*, from *natrium*, the Latin name of the element. Sodium and potassium have many common characteristics. Both are alkali metals, their compounds with hydrogen and oxygen being strongly alkaline. Both are intensely active chemically, and when thrown upon hot water they unite with oxygen so violently that hydrogen is liberated and sufficient heat generated by chemical action to set the hydrogen on fire; the presence of sodium vapour causes a yellow flame. The affinity of sodium for water is so great that it has to be kept in kerosene or naphtha.

Sodium constitutes about 2.6 per cent of the earth's crust, as compared with 2.4 per cent for potassium. Neither is found free in nature.

Sodium exists in large quantities in common salt (sodium chloride), which is a compound of this element and chlorine. The sodium is obtained in various ways the newest of which is the electrolytic process, in which the salt molecule in brine is split into sodium and chlorine by means of an electric current.

SODIUM NITRATE. See under SALT-PETRE.

SODOM. One of the ancient "cities of the plain," north of the Dead Sea. It lay in a region described in Genesis xiii. 10 as having been "as the garden of the Lord," till Sodom and Gomorrah, a neighbouring city, were overthrown by God because of the wickedness of their inhabitants. The modern word "sodomy," designating the perversion which the people of Sodom practised, is derived from the name of the town.

SOFIA, *so'fe a*, or *so'fe'a*. Capital of Bulgaria (which see).

SOIL. The surface of the earth was at one time bare rock, but a process of weathering (which see) the surface of the rock has almost everywhere been broken into fine particles, which we may call soil. As commonly understood, soil is not composed of rock dust alone, but it contains also organic matter derived from the decayed vegetation which, has grown there. The mineral matter, too, has undergone many chemical changes since it was part of the rock, due not only to the plants feeding upon it, but also to the action

of natural forces such as sunshine, rain, air, and lightning.

SOKE, SOC, OR SAC. A term of Anglo-Saxon origin to express the right of the lord of a manor to hold a local court. It survives in the name of an English administrative county—Soke of Peterborough—which is part of the geographical county of Northamptonshire.

SOKOTRA. A lofty rocky island of 1400 square miles lying east of Cape Guardafui at the mouth of the Gulf of Aden. Its population of about 12,000 are of mixed Arab, Indian and negro descent. The climate is warm and fairly dry; there are some fertile areas. Pasturage and fishing are the chief occupations. At one time the inhabitants were Christian, but from the sixteenth century, under allegiance to an Arab sultan, they embraced Islam. The island was occupied by Great Britain in 1835, and was made a protectorate in 1876 and annexed in 1886. It is now part of the Aden protectorate. The chief village is Tamarida.

SOLANUM, *so lay' num*. The most important genus of the nightshade family of plants. It includes herbs and shrubs of more than 500 species. The most common and important species is the common potato. Other well-known species of temperate regions are the bittersweet and the common nightshade. See also **BELLADONNA**.

SOLAR PLEXUS, *plek' sus*. A nerve centre situated in the abdominal cavity between the aorta and the stomach. It is a network of sympathetic nerve threads (see **NERVOUS SYSTEM**), connected by numerous branches with the vital organs of the abdomen, and is sometimes called the *abdominal brain*. Because of this arrangement, the organs of digestion and elimination and the heart are all interconnected.

SOLAR SYSTEM. The earth is one of countless bodies that travel round the sun, receiving and reflecting its light and heat in greater or less quantities according to their nearness to or distance from it. There are the nine large *planets*, of which our earth is fifth in size; next, there are the smaller *planetoids* or *asteroids*, which are counted in hundreds; lastly, there are the myriads of *meteors*, which travel in swarms and are so small that they are not visible unless they come in contact with our atmosphere, whereupon they become incandescent and are seen as shooting stars. Besides all these, there are the *comets*.

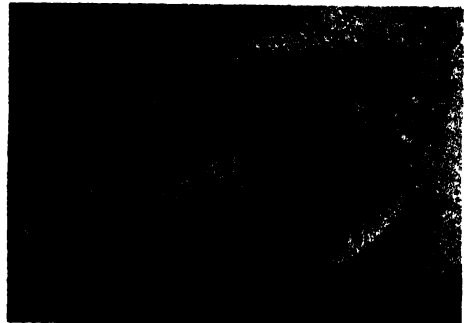
None of the members of the solar system moves about the sun in an exact circle, though all have regular orbits. When the distance of any one from the sun is stated, its mean distance is meant. A peculiar fact about the distance of the larger bodies, first shown to the astronomical world in 1772

by a German named Bode, may be seen in the following table—

	TENS OF MILLIONS OF MILES FROM SUN	BODE'S NUMBERS
Mercury	3.59	4
Venus	6.72	7
Earth	9.29	10
<i>Planetoid Eros</i>	13.55	—
Mars	14.15	16
<i>Planetoid Ceres</i>	25.70	28
Jupiter	48.33	52
Saturn	88.60	100
Uranus	178.19	196
Neptune	279.25	388

Bode formed his series of numbers by adding 4 to each number in the series, 0, 3, 6, 12, 24, 48, 96. In his day, the planets and planetoids italicized in the above table were unknown, but it was seen that the distances of six known planets corresponded very closely to his numbers. In 1781 Uranus was discovered, and was found to correspond fairly well with another number in the table. Astronomers began to take more interest in Bode's Law, and their search for a planet to correspond to the missing number 28 resulted in the discovery of Ceres and other asteroids. See **ASTEROIDS**; **COMET**; **METEORS**; **PLANET**.

SOLE. Family of flat-fish having the characteristic twisted cranium and both eyes on the right side of the body (see **FLAT-FISH**). The eyes are small and set close together, the



SOLE
Photo: Weller

mouth is crooked, and the body is a flattened oval. These fish are found in temperate seas near shore. The European species is valuable as food, because its flesh is firm and white and of good flavour. The European sole grows from 10 to 20 in. in length, and averages about a pound in weight.

Scientific Name. The European sole is *Solea vulgaris*.

SOLENHOFEN, *so' len ho fen*, **STONE.** A fine-grained limestone of uniform texture, slightly porous and containing only a little clay. It occurs in the Upper Jurassic rocks

of Solenhofen in Bavaria, where it is quarried for use in lithographic printing. Fossils found in it are preserved with the greatest of perfection.

SOLICITOR. In Great Britain, as in some other countries, the legal profession is divided into two distinct branches, each with its own organization and sphere of activity, so distinct indeed that membership of the one is incompatible with membership of the other. One of these branches is the Bar (see **BARRISTER**). The members of the other used to be known by various names according to the Courts in which they practised, viz. attorneys in the Common Law Courts, solicitors in the Court of Chancery, and proctors in the ecclesiastical Courts. Since the amalgamation of the Courts in 1873 (see **COURTS**) they have all alike been styled "Solicitors of the Supreme Court," and are generally known simply as solicitors. A candidate for admission as a solicitor has to pass a series of examinations, and also to serve for five years (subject to some reduction in the case of a University graduate) as an "articled clerk" (i.e. apprentice) with a firm of practising solicitors. On fulfilling these qualifications, the candidate is entitled to be admitted and entered on the roll of solicitors. But before he can practise he must take out a practising certificate, which is renewable annually on payment of a duty (£9 for London solicitors, £6 for country solicitors, with a 50 per cent reduction in the first three years of practice). The ordinary work of a solicitor consists in giving advice and drawing legal documents, and, where necessary, instructing barristers on behalf of his clients. Some solicitors also act as advocates in the County Courts and at Petty or Quarter Sessions; in the superior Courts only barristers have the right of audience. In the absence of a special agreement, a solicitor is only entitled to charge according to a fixed scale.

SOLICITOR-GENERAL. A law officer of the Crown who, together with his senior, the Attorney-General, forms the Law Officers' Department which is responsible for conducting Crown prosecutions, representing the Crown in legal proceedings, and acting as legal advisers to Government departments. The allocation of duties between these two Law Officers is a matter of arrangement. Scotland has its own Solicitor-General, whose senior is the Lord Advocate, and there is one for the County Palatine of Durham who represents Crown interests in the Chancery Court of Durham.

SOLITAIRE, *sol it air'*. The collective name of many games to be played by one person. Under the name of *patience*, card games have been known and played for

centuries, though few ancient writers give details of the various games. In some variations of *solitaire*, the exercise of skill and judgment is necessary, but in most they depend entirely on the element of luck.

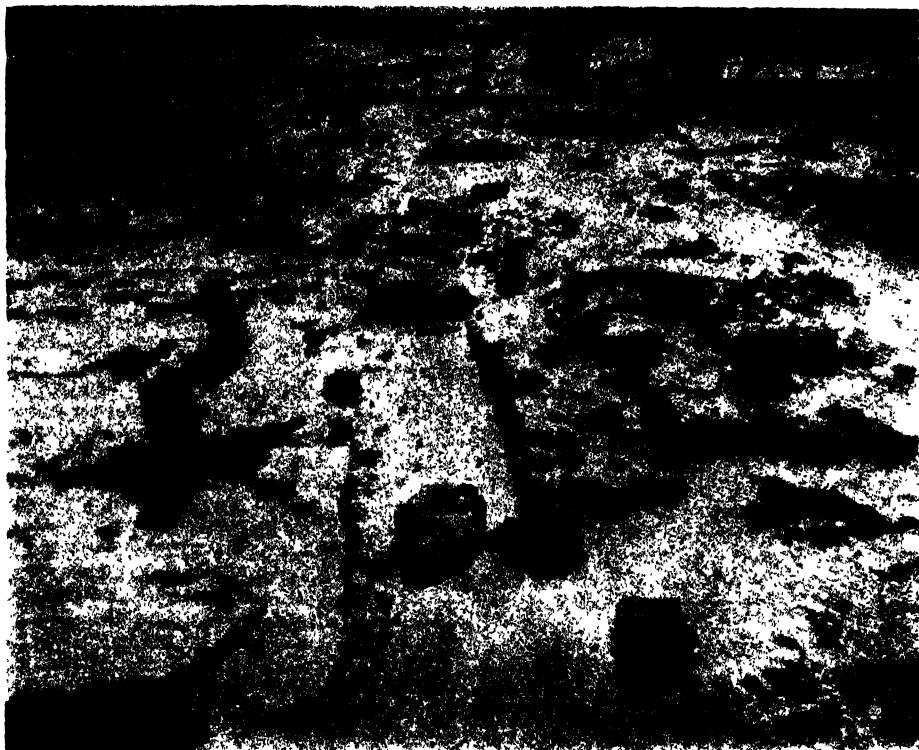
SOLOGUB, *sol' o goop*, FZODOR. See **RUSSIAN LITERATURE**.

SOLOMON. The third king of Israel, son of David and Bathsheba. His reign extended from about 970 to 930 B.C. He was born in Jerusalem. When King David was about to die, Solomon's brother Adonijah attempted to make himself king, but David had promised Bathsheba that Solomon should succeed him, and Bathsheba and Nathan told David of Adonijah's conspiracy. David then ordered Nathan to ride with Solomon to Gibeon, and there to have him anointed king by Zadok, the priest. Solomon was probably about 20 years of age when he became King. It is recorded in the Old Testament that he was visited by God in a dream, and asked that wisdom should be conferred on him in preference to any other gift, at which the Lord was pleased and promised him wealth and honour in addition.

His Achievements as King. According to the account given in I Chronicles, David, before his death, gave Solomon the plans and full directions for building the Temple, for which he had gathered most of the material. The structure was begun in the fourth year of his reign, and seven years were required for its completion. Solomon also had fleets of ships on the Red Sea and on the Mediterranean, manned by Phoenician sailors because the Israelites were not acquainted with the art of navigation. He extended the commerce of his kingdom to all surrounding nations, and his ships, for that age, made long voyages. As a result of his promotion of trade he gained great wealth.

Soon after he became king, Solomon made an alliance with Pharaoh, King of Egypt, and married his daughter.

Solomon's Wisdom. The "wisdom" of Solomon has become proverbial; but, as is justly remarked by critics, it has been exaggerated and overpraised. He has no claim to the depth of thought of a Plato or a Socrates. Solomon was a man of very high culture for his time, a discerning judge, quick in his decisions, learned and able to speak instructively on many subjects, and with a peculiar skill in making up or solving riddles and abstruse theorems. He excelled also in the composition of short sentences setting forth in a terse way some maxim of prudence or morality. He is said to have spoken 3000 of these proverbs. How far the Old Testament Book of Proverbs contains actual examples of his sayings is a matter of doubt, but it is generally agreed that the whole of



REMAINS OF THE STABLES OF SOLOMON

These ruins, unearthed in 1928, show that the horses stood facing each other, about twelve in a row with a passage between them for the grooms. In front of each horse was its manger. Stone hitching posts, in which the tie-holes for halter ropes remain, stood between the rows of mangers. The stalls were made of large, hollowed stone blocks.

Photo: U. & U.

the wisdom literature in the Bible and the Apocrypha bears the mark of an influence which may be called *Solomonic* in the sense that it derives its characteristics from him.

Later Years. Contrary to the Hebrew ideals, Solomon established a harem, and made alliances with women of the surrounding heathen nations. In time, to please these women, he erected altars to their gods in and about Jerusalem. This weakened his influence over the Israelites, and caused dissension in his court. Moreover, the extravagance of the court caused a heavy burden of taxation, under which the people became restive. According to legend, Solomon had a son by the Queen of Sheba (or Saba, in southern Arabia), from whom, in later days, the Ethiopian line of kings claimed descent. Solomon reigned forty years, and was succeeded by his son Rehoboam.

SOLOMON ISLANDS. A group of several large and many small islands lying in the Western Pacific Ocean between lat. 5° S.

and lat. 11° S. They are arranged in two parallel rows of mountainous volcanic islands with many coral reefs. Several of the smaller islands are built entirely of coral. Heights reach as much as 8000 ft., but the larger islands have much lowland. The total land area of the group is estimated to be about 15,000 square miles. The largest are Bougainville (3880 square miles), Guadalcanar (2500 square miles), Malaita (2000 square miles), Isabel (1800 square miles), Choiseul (1500 square miles) and Buka (190 square miles). Temperatures are always high and rain is abundant, especially from December to April. Forests and mangrove swamps abound. The population is Melanesian, and with some 500 Europeans totals about 100,000. The natives live on fish, game, fruits and root crops. Copra and pearl shell are exported.

The whole group, except Bougainville and Buka, has been a British protectorate since 1893 under a commissioner resident at

Tulagi. The protectorate also includes the Santa Cruz group to the east (200 square miles) and the Lord Howe or Ontong Java group to the north, a huge atoll over 20 miles in diameter. Buka and Bougainville were German possessions from 1885 to 1914,



and formed part of the New Guinea protectorate. They are now governed by Australia under a League of Nations mandate. The Solomon islands were discovered by Mendaña in 1568, but are still largely unexplored, chiefly because of the hostility of the natives.

SOLOMON'S SEAL. Various perennial plants bear this name, which comes from seal-shaped scars on the creeping rootstock. In the "common" variety the stem is up to 2 ft. tall. The oblong leaves grow from the stem without a stalk and are borne alternately. The flowers are white but flushed with green at the tip. They are like elongated bells and droop from a stalk which springs from the leaf joint. The flowers are succeeded by red or purplish berries according to the varieties. The plants were once thought to have medicinal properties.

Scientific Names. Solomon's seal belongs to the lily family, *Liliaceae*. The common variety is *Polygonatum officinale*.

SOLOMON, SONG OF, OR CANTICLE OF CANTICLES. One of the books of the Old Testament, a dramatic poem written in celebration of wedded love. In its present form, the original assignment of parts to characters is difficult to restore.

In Jewish theology, The Song of Solomon is considered as an allegory, picturing the close relationship between God and Israel. Some Christian commentators regard it as symbolizing the union of Christ and the Church. It is almost certainly not Solomon's composition.

SOLOM, *so' lōn* (about 639-559 B.C.). An Athenian statesman, famous in classical legend as one of the "seven wise men of Greece." His first public service consisted in an appeal to the Athenians, which led to the regaining of the island of Salamis. About

594 B.C., he was elected archon, and promptly instituted legal and governmental measures, "the Solonian decrees."

This legislation arose naturally out of the strained economic situation. Money had accumulated in the hands of a comparative few; interest was high, and the small farmers had been compelled in many instances to mortgage their land, while the free labourers had sold themselves into slavery in order to live. Solon lightened the burdens on debtors.

His constitutional reforms consisted in a redivision of citizens into four classes, according to income. Solon left the constitution of Athens oligarchic, but the granting of legal privileges to every citizen was a step toward democracy.

According to tradition, Solon pledged the Athenians to keep his laws for ten years, and left the State for that length of time. Civil strife broke out almost immediately, however, and before the death of Solon, Athens had come under control of the tyrant Pisistratus. See **PISISTRATUS**.

SOLSTICE, *sol' stis*. A term used in astronomy to describe the point in the ecliptic at the greatest distance from the equator either north in summer or south in winter. The word is derived from the Latin *solstitium*, meaning "a standing still of the sun." In the spring, the sun crosses the equator about 20th March, the vernal equinox; continuing its northward journey, it reaches the farthest point north about 21st June, the summer solstice. The sun apparently stands still, or holds the same position for several days, before starting southward. Crossing the equator again about 23rd September, it reaches the southern winter solstice about 22nd December.

SOLUTION, *so lu' shun*. When the particles of a solid, such as sugar, or of a gas, as carbon dioxide, or of a liquid, as alcohol, mingle with the particles of a fluid so completely that a uniform liquid results, a *solution* is formed. The fluid in which the substance is dissolved is called the *solvent*, the substance dissolved is the *solute*. The resulting liquid is not an example of chemical but physical change, for a new chemical compound is not formed. When any solvent has dissolved as much of a given substance as it can, the solution is said to be *saturated*. At the same time, it may not be saturated with respect to another substance, for a saturated salt solution will dissolve sugar.

SOMALILAND PROTECTORATE. A British possession in the east of Africa bordering the Gulf of Aden. The protectorate is about 68,000 square miles in area, and has a population estimated to be about 345,000, consisting of Somalis, a race of mingled negroid and Hamitic blood. Nearly

all of the natives are Mohammedans, and, with the exception of those who dwell in the coast towns, they are wandering herdsmen. With a hot, dry climate the vegetation is mainly scrub, and little agriculture is possible. The interior is lofty and better watered. Berbera, the largest town and the seat of government, has between 15,000 and 30,000 inhabitants, the number increasing during the trading season. Hargeisa (20,000) is the second largest city. Exports include skins, cattle and sheep, gum and resins, ostrich feathers, and ivory. In 1884 a British Protectorate was established. It was under the government of India until 1898, the Foreign Office until 1905 and thereafter the Colonial Office. The limits against Italian territory were defined in 1894 and against Abyssinia in 1897, when part of the British Protectorate was ceded to Abyssinia. From 1899 to 1920 a fanatical Somali chief, called the Mad Mullah, caused much trouble. The protectorate is ruled by a Commissioner. See also FRENCH SOMALILAND; ITALIAN SOMALILAND.

SOMERSET. A south-westerly county of England, with an area of 1,036,818 acres and a population (1931) of 475,120.

Physical Features. Distinctly hilly in parts, and containing a considerable area of moorland and heather country, it has within its boundaries some of the most fertile country of the west, and is especially noted

for its apple orchards cultivated for the famous Somerset cider. In the east of the county the Mendips stretch from north-west to south-east, and occupy with their foothills practically the whole area north-east of a line drawn from Shepton Mallet to Weston-super-Mare. Parallel with these, and separated by a broad alluvial valley, are the Polden Hills. West of these again is another alluvial valley, that of the River Parret. Finally, everything west of a line drawn from Chard through Taunton to Watchet is hilly in character, comprising the Quantock and Brendon Hills, Exmoor Forest, and further south, the detached range of Blackdown.

History. Somerset, like Dorset, takes its name from a Saxon tribe—Somersætas—whose principal city was Somerton. In early British history it played an important part. Under the Romans it was the chief area of development in the west. Ilchester and Bath were the two principal Roman towns. Its complete colonization is shown by the remains of baths and other traces of domestic establishments at Bath, and by the number of roads which radiate across the county, the chief of which was constructed on the site of the ancient British trackway, the Fosse Way, from Bath to Chard.

By the eighth century Somerset formed part of the Kingdom of Wessex, but its conquest extended over two centuries, and for a long time it was the most westerly



dominion of the Saxons. It proved to be a cockpit of fighting in the struggle between the Danes and Alfred the Great, and the scene of the final defeat of the former, for the site of the Battle of Ethandun in 878, when Alfred utterly routed the Danes under Guthrum, is credibly placed at Edington—a village in the Polden Hills. Aller, where the defeated Guthrum was baptized, and Wedmore where the treaty was signed by which

feated, was followed by the inhuman proscription of Judge Jeffrys.

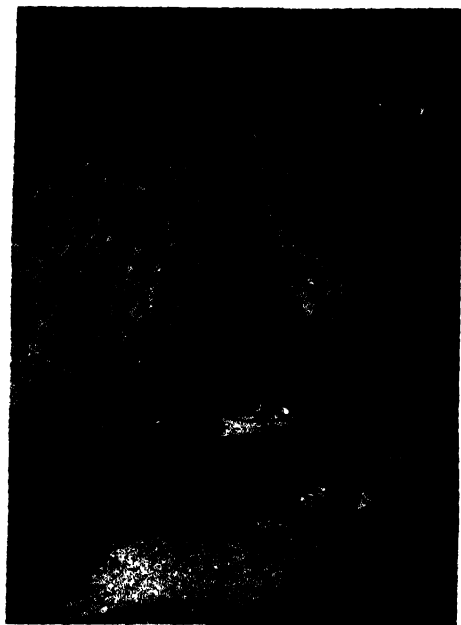
The county is represented in Parliament by seven members.

Agriculture and Industries. Industrially Somerset's importance lies in the past. To-day, with a few exceptions mentioned below, it is a purely agricultural county, the greater part of which is given over to permanent pasture. Sheep, cattle and pigs all flourish exceedingly, and the sheep of the Brendon Hills and the Mendips produce an exceptionally fine quality of wool. Cereal crops are diminishing, and only a small quantity of wheat is raised in the central lowlands. Market-gardening is successfully carried on in the north-east in the proximity of Bristol. Orchard lands are scattered principally in the neighbourhood of Taunton. The manufacture of Cheddar cheese, once peculiar to the county, is carried on in a small way. Paper mills, breweries, and engineering works are found in some of the larger towns. Lace is manufactured at Chard, and printing is carried on at Bath and Frome. There are also a number of quarries. Formerly iron ore was raised in the Brendon Hills, and the manufacture of cloth was a staple industry when Dunster cloth was much in demand.

Antiquities. Standing stone monuments of the early British era are rare, the most notable being the stone circle on Stanton Moor. Earthworks, on the other hand, are numerous, and some are in an excellent state of preservation. Those on Solsbury Down and Combe Down are two of the most remarkable, whilst that at Worlebury, in addition to the earthen ramparts, has a number of well-marked digging, within the defences which may have been the prehistoric forerunner of the modern dug-out. The other antiquity of chief importance is the remains of a lake village discovered at Godney Marsh near Glastonbury. This is probably of Celtic origin of the first millennium B.C.

The Roman era is best demonstrated by the many relics of that period at Bath (which see), and by the several Roman roads, some of which are still in use. The foundations of several villas have been discovered in various parts of the county, most notably perhaps, at Pitney and Waleford. By the village of Whistestaunton, in addition to a large Roman villa, traces of Roman mine workings have been discovered.

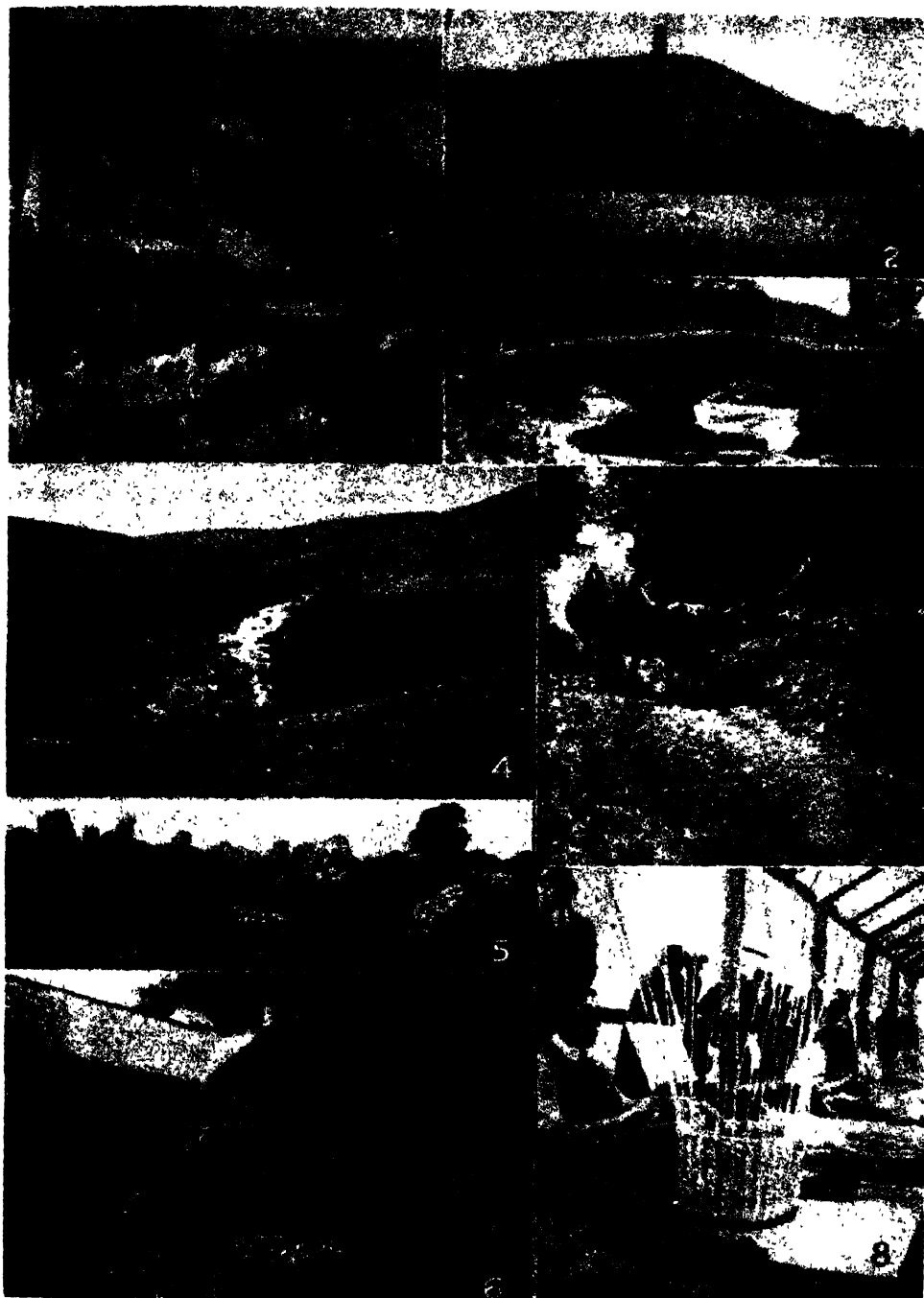
Of the few medieval castles that at Taunton is probably the best preserved. The ruins of Nunney Castle near Frome are very picturesque, and date from the fourteenth century. Dunster Castle, a Norman edifice raised by William de Mohun, is also of great interest. If poor in military architecture,



THE ENTRANCE TO WOOKEY HOLE, MENDIPS

the Danes were confined to the eastern counties, are both in central Somerset. Several Saxon kings were buried at the Abbey of Glastonbury, whilst Bath was the scene of the coronation of Edgar.

The Norman Conquest passed without incident, but Castle Cary was held in 1135-1136 on behalf of Matilda. In the Civil War the towns at the outset mainly favoured the cause of Parliament, the country districts that of the King, but in 1643 and 1644 the King's troops were in occupation of most of the strategic points. At the Battle of Lansdowne Hill, 1643, General Waller was defeated with great loss. Two years later Taunton was besieged by the Royalists and was only relieved after the siege of Dunster which lasted nearly six months. The latter cleared the county of Royalist support. The Duke of Monmouth's rebellion in 1685 was centred in Somerset. The Battle of Sedgemoor, in which the Duke was de-



SOMERSET

1. The Lion Rock in the Cheddar Gorge. 2. Glastonbury Tor. 3. Double pack-horse bridge at Dunster. 4. The valley of the Barle, Exmoor. 5. Stanton Drew Circle, most notable standing-stone monument in the county. 6. The old mill at Dunster. 7. Country lane near Winsford. 8. Basket-making competition at Taunton.

Photos: George Long; Davies; Somerset Rural Community Council

Somersetshire is rich in medieval religious houses, and the cathedral at Wells (which see) and the Abbey at Bath (which see) are of the utmost importance. The most interesting ruins are those of Glastonbury Abbey.

Principal Towns. The county town is Taunton (which see); the Cities of Bath and Wells, the urban district of Minehead, and the municipal borough of Weston-super-Mare and Glastonbury are treated separately.

Bridgwater. A Municipal Borough and formerly important seaport situated at the mouth of the Parrett, with an area of 1084 acres, and a population in 1931 of 17,139. The castle which was held for the King in the Civil War has disappeared.

Chard. A Municipal Borough and market town with an area of 442 acres, and a population in 1931 of 4053, situated near the southern boundary of the county. Of Saxon foundation, it became at the beginning of the present century the principal remaining town engaged in the lace industry.

Yeovil. A Municipal Borough situated on the River Yeo with an area of 2257 acres, and a population in 1931 of 19,078. It is one of the largest market centres in the country, acting as a clearing-house for the fertile Vale of Blackmore, and has also local industries connected with the manufacture of leather.

SOMERSET, DUKES AND EARLS OF. Sir John Beaufort (d. 1410), son of John of Gaunt and Catharine Swynford, was created by Richard II Earl and later Marquess of Somerset, and Marquess of Dorset. His second son John, third Earl (d. 1444), was in 1443 raised to a dukedom and appointed Lieutenant-General of France; his daughter Margaret was the mother of Henry VII. Edmund, the third son, was granted the dukedom in 1448. He was Regent of France, and the French successes made him unpopular. He was killed in 1445 at the Battle of St. Albans. His son Henry, second Duke, was beheaded by the Yorkists after the Battle of Hexham in 1463. His brother Edmund, the third Duke, fought at Barnet and was beheaded after Tewkesbury.

The title was again conferred in Tudor times. **EDWARD** (1506-1552), the son of Sir John Seymour, as a youth served in the French War, in the retinue of Cardinal Wolsey and in the royal household. His sister Jane became Henry's third Queen in 1536, whereupon Sir Edward Seymour was raised to the peerage as Viscount Beauchamp. On the birth of an heir, the future Edward VI, he was created Earl of Hertford. His rise to wealth and influence continued notwithstanding the death of his sister. He was associated with Cromwell and Cranmer.

During the last two years of Henry VIII's reign Hertford was busily intriguing for

power in view of the prospect of a regency. His great rivals the Duke of Norfolk, and his son the Earl of Surrey, representing the Catholic interest, were removed by a Bill of Attainder, and on the death of Henry VIII in 1547 Hertford found himself in complete command of the situation.

The executors of Henry's will appointed him guardian of the young King, under the title of Protector, with almost unlimited prerogatives. He issued the First Prayer Book to advance the Reformation policy and repealed the laws against the Reformers. In 1549 he crushed a Cornish rising against his new Prayer Book, but expressed sympathy with the people of Norfolk, who had risen under Ket to protest against unjust enclosure of common lands. The Lords of the Council, who themselves had freely committed the same offence, banded against him and he was dismissed from the Protectorship, his place being taken by the Earl of Warwick, who was created Duke of Northumberland. Somerset was sentenced for conspiracy, and executed on Tower Hill in January, 1552.

The dukedom was restored to William, his great-grandson by his second marriage (see SEYMOUR, FAMILY OF). From Elizabeth, daughter and heiress of Algernon, seventh Duke (d. 1750) the Duke of Northumberland is descended. The present Duke of Somerset is descended from Sir Edward, son of the Protector by his first wife.

The title of Earl of Somerset had been borne early in the sixteenth century by Robert Carr, a handsome young Scotsman. He was noticed by James I, who created him Viscount Rochester, and he was guided through the intrigues of the court by his far abler friend, Sir Thomas Overbury. Carr fell in love with the beautiful and shameless Frances Howard, who had been married in her 'teens to the Earl of Essex. Overbury won her hate by counselling Carr against her, and Carr's influence with James sufficed to send his friend to the Tower, and to institute divorce proceedings. On the day before the marriage of Essex was dissolved, Overbury died. Carr was made Earl of Somerset but was soon supplanted in royal favour by the more brilliant George Villiers. He and his Countess were charged with the murder of Overbury through the agency of a warder, Weston. They were found guilty, and imprisoned for some years in the Tower.

SOMME, RIVER. A river in the northern part of France, flowing into the Channel; length, 140 miles. For an account of the Battles of the Somme, see WORLD WAR.

SOMNAMBULISM OR SLEEP-WALKING. Sleep-walking occurs as a habit in a small percentage of persons. It may occur as a development of hysteria, but more often no

particular cause can be found for this abnormality. A person will rise from his bed, walk about, sometimes perform actions connected with his ordinary occupation, all the time being uninfluenced by external impressions; then he will return to bed, to remember nothing of it when he wakes. Usually these people do not speak.

SOMNUS. The Roman god of sleep, corresponding to Hypnos of the Greeks. He was the son of Nox (night) and the brother of Mors (death).

SONATA, *so nah' ta*. An instrumental composition consisting of three or four movements played in different rhythms, but related in thought. The typical four-part sonata begins with a moderately fast movement, then passes to one of slow and lyrical character. The third movement is light and graceful, and may be a minuet or scherzo; the fourth is a brilliant finale. A sonata written for the orchestra is called a *symphony* (which see).

The first movement and occasionally other movements of a sonata have a characteristic form known as *sonata-form*. In the *exposition* section (sometimes preceded by an introductory section) certain musical material is stated; a *first subject* (idea or group of ideas) in the main key of the movement, and a *second subject* in a related key. Next in the *development* section that material may be treated with great freedom of modulation and variation. Finally the *recapitulation* section repeats the exposition more or less exactly, except that a coda may be added to complete the movement, and that the first and second subjects are no longer in contrasted keys but are both in the main key of the movement.

SONNET. A type of poem which is limited to fourteen lines, rhymed according to a definite scheme. It is a form of lyric poetry (which see). This verse form originated in Italy, and was given its classic form by Petrarch. He arranged the lines of a sonnet in two groups, an eight-line group known as the *octave*, and a six-line group known as the *sestet*. There are but two rhymes in the octave, the usual arrangement being *a b b a, a b b a*, while the sestet may have either two or three rhymes, which may be placed according to various schemes. The commonest form is *c d e, c d e*. The sestet may not, however, be broken into couplets.

The sonnet was introduced into England about the middle of the sixteenth century by the Earl of Surrey, and was very popular with the writers of the Elizabethan age, Spenser and Shakespeare each producing numerous examples. They varied the rhyme scheme, however, from the Petrarchan original. Instead of two quatrains and a sestet, Shakespeare made of the sonnet

three quatrains and a couplet, rhymed usually *a b b a, c d c d, e f e f, g g*.

As it is so brief, the sonnet must be limited to one idea or emotion. Shakespeare, Milton, Wordsworth, and Keats are the great names in the history of the sonnet in England.

SOOT. A fine black substance deposited by smoke. It results from the imperfect combustion of fuel, such as wood, coal, or oil, and contains carbon and ammonium salts. The soot nearest the fire is often a shining brown powder containing dried tar; it is used as a pigment under the name of *bistre*. The blacker soot farther up the chimney, especially that from oil or resin, is the pigment *lampblack*. Soot adheres to anything with which it comes in contact, hence smoke blowing through a city deposits its soot upon the buildings in its path.

SOPHISTS, *sof' ists*. The name given to itinerant instructors in Greece in the fifth and fourth centuries B.C., previous to the rise of the schools of philosophy under Plato and Aristotle.

They taught disputation, rhetoric, and politics, taking fees from their pupils, and for a hundred years provided the only form of University education. They had no definite philosophy, but were, in general, sceptical and indifferent to truth. Their influence on literature and oratory was beneficial, but their methods of reasoning were alleged to have a mischievous effect on conduct. They were despised by Socrates and his school, who taunted them with "selling wisdom" and with taking pride in "making the worse appear the better." Among famous sophists were Protagoras, Gorgias, and Hippias.

SOPHOCLES, *sof' o kleez* (about 495-405 B.C.). A Greek dramatist, born at Colonus, a suburb of Athens. At the age of 28, he submitted his first play, *Triptolemus*, in competition with Aeschylus, and won first prize. He served in political offices as a patriot, rather than as a politician. In 440 B.C., he was chosen one of the board of generals in the war against the aristocratic party of Samos, was later general in the Peloponnesian War, and a member of the committee that reported on the proposed oligarchical constitution for the State. In his old age he



SOPHOCLES
Photo: British Museum

held a minor priesthood, and at his death was given heroic honours. See also GREEK LITERATURE.

His Place in the Drama. His dramas, of which seven out of a total number of 120 are extant (with fragments of others), represent marked development in dramatic technique. He introduced a third actor, thus enlarging the scope of the action; increased the chorus from twelve to fifteen members and subordinated it to the main plot, thus making it essentially the ideal interpreter of the action; and completed each play in itself, instead of grouping three about a central theme, as Aeschylus and other dramatists had done.

Sophocles ranks with Aeschylus and Euripides as one of the three great figures in Greek tragedy. His style is intermediate between the other two, and in purity of diction and technique is unsurpassed by either of them.

Antigone, Oedipus Tyrannus, Ajax, Electra, Trachiniae, Philoctetes, and Oedipus at Colonus are the only plays of which there are now complete copies.

SORGHUM, *sor' gum*. A group of plants belonging to the grass family, one class of which contains a sweet sap from which syrup is made. The sorghums are tall, earless plants, bearing terminal heads of small seeds. The syrup-yielding plants are known as *saccharine* or *sweet* sorghums, and the others as *non-saccharine* or *seed* sorghums. The saccharine varieties are cultivated for their sap and as forage plants.

SORREL. The common sorrel is a familiar plant in meadows throughout the summer. It grows on a tough stem one or two feet high. The flowers, at first green and then turning crimson, are born on small spikelets either from the main stem or branches. The leaves are shaped like an arrowhead and grow mainly from the root, but also up the stem. In the latter case they have no stalk. They are acid in flavour and are useful for salads.

Scientific Names. The common sorrel is *Rumex acetosa* in the family *Persicaria*. Among other British plants known by this name are the mountain sorrel (*Oxyria reniformis*) and wood sorrel (*Oxalis acetosella*, order *Geraniaceae*).

SOUND. The audible expression of a mechanical disturbance of some kind. Most of the manifestations of energy round us give rise, directly or indirectly, to sound. The principal sources of sound arise either from the vibration of the surfaces of solids or from the emission of air or other fluids from orifices. As will presently be seen, the effective production of sound is almost invariably attended by the phenomenon of "resonance."

Solid bodies, such as a sheet of metal, may

vibrate, as the result of a blow, in a very complicated manner. Large regions of the surface may vibrate at comparatively slow rates, smaller regions within the larger ones at faster rates, and so on. The different rates of "frequencies" of vibration give rise to tones which, if they existed separately, would be identified as having different pitches, the higher frequencies producing the higher pitches.

The ear is so sensitive that the range of the vibration required to create an audible tone may be, and generally is, exceedingly small, often considerably less than a millionth part of an inch. In the case of vibrating solid surfaces, if they are dusted with powder the different forms of vibration of which the surface is capable may sometimes be revealed as patterns traced by the powder.

Most of the sounds we experience are made up of mixtures of pure tones of various intensities and frequencies. The quality or timbre of a sound is bound up with its composition, the low tones usually giving volume and deciding the pitch which we assign to the mixture, while the high tones give character (just as they do in speech) and are the ones by which we mainly identify the nature or source of sounds. Pitch and timbre are appraised solely by the ear, the other subjective feature of sound being loudness. Intensity and frequency we can measure instrumentally. With regard to frequency, the extreme range of the ear is from, say, 16 to 20,000 cycles per second, the upper limit declining substantially with advancing years. Present-day technical acoustics confines itself, however, to a narrower range, from say 50 to 10,000 (The middle C of the piano has a frequency of 261).

Musical Sounds. A sound is recognized as a musical note if the frequencies of the component tones are, for the most part, related on a musical scale. Unfortunately with many generators of sound, other than those designed to produce musical notes, the component tones are seldom so related, and the effect may be anything but musical.

The simplest relation recognized by the ear between the pitches of two notes is that of the octave. There are several ways of proving that this simple relation of sensations corresponds to the simplest numerical relation (two to one) in the frequencies of vibration. Perhaps the most convincing of these proofs is obtained by means of a siren (which see). If this is rapidly rotated, and a jet of air is directed first on to one circle of holes and then on to the other, the number of impulses must of necessity be in the ratio 2 : 1, and the ear will recognize that the sounds produced are at an interval of one octave. The next simplest numerical

ratio is 3:2, and this corresponds to what is known in music as a fifth, e.g. the interval from C to G (doh to soh in tonic solfa).

Sounds are often generated in musical instruments by the vibration of strings, permitting a variety of controls over the frequency which, for example, is doubled (a) by halving the length, or (b) by quadrupling the tension, or (c) by quartering the

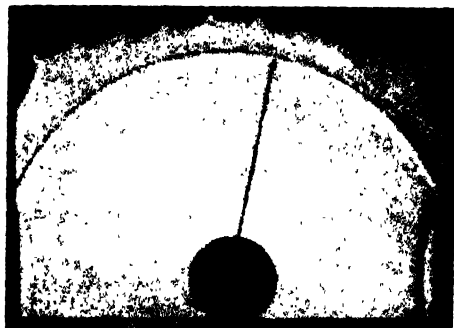


FIG. 1. PHOTOGRAPH OF A SINGLE AIR WAVE

weight of the string. In the case of wind instruments, the frequency depends on the lengths of the pipes, and whether or not they are open or closed at the ends.

Resonance. As mentioned above, the phenomenon of resonance is often utilized to give certain acoustical instruments greater effectiveness. For example, a vibrating string, owing to its shape, has little power of imparting its vibrations to the air, and consequently most stringed instruments depend on resonators to give them "body." A notable exception is the harp, and the weak tones of this instrument, as compared with the piano, form a good illustration of the value of the resonance imparted by the sounding board of the latter. The church bell, the dinner gong, the whistle and the organ pipe are primary examples of resonators designed to produce sound.

The distinguishing character of resonance is that it reinforces some sounds more than others; in fact, a resonator has one or more natural frequencies which it could itself emit if suitably excited, and it is to these frequencies that it responds. The wires of a piano can thus act as resonators, and it will be found that if a note is sung loudly in front of a piano with the loud pedal depressed so as to remove the dampers from the strings, then all the strings corresponding to component tones in the note sung will be set into vibration.

The phenomenon of resonance has to be taken into account in the design of telephones and loud-speakers. If such an instru-

ment has a resonance within the region of frequencies to be reproduced, then any sounds of this frequency will be unduly magnified. It is therefore essential either to ensure that all resonances are far removed from the region in question, or else that they are so evenly distributed that they lead to practically uniform reproduction.

Sound Waves. Whenever there is a mechanical disturbance, sound waves tend to spread from the source in all directions. These waves are made up of a series of ever-expanding globular "shells" of compressed air, alternating with similar shells of rarefied air. The resulting alternations of pressure produce the sensation of sound in the ear. Such shells or pulses can be seen and photographed under suitable conditions. Fig. 1 shows a photograph of a single pulse of sound. The fluctuations of the air pressure are normally small, amounting to only about a millionth part of an atmosphere for a note of ordinary loudness and medium frequency.

Sound waves are fundamentally and mathematically similar to ripples on the surface of water, though they are very different in their actual processes. Particles on the surface of water, (Fig. 2) move up and down, i.e. across the direction of travel of the wave, while particles in a sound wave in air vibrate in the direction of travel of the wave. With the water the controlling force is the weight and surface tension of the water, in air it is the atmospheric pressure.

The speed of travel of sound waves in air is about 1090 ft. per second at 0° C., the



FIG. 2. AS WAVES ENLARGE IN CIRCLES FROM THE POINT OF DISTURBANCE, SO DO SOUND WAVES TRAVEL FROM THE SOURCE

speed increasing about 2 ft. with each degree C. This is vastly inferior to the speed of light, as is evidenced by the lag of the thunder clap behind the light of a distant lightning flash. Sounds must have a medium in which to travel and consequently do not progress at all in a vacuum (see Fig. 3). In solids and liquids, sound travels faster

than in air, each substance having its own characteristic speed.

If a sound is generated within or enters a room, the sound waves are reflected by the walls and other solid surfaces and, in effect, they "bounce" about the room in all directions until they are finally absorbed. A hard wall is a better reflector of sound than most mirrors are of light; and so sound waves may travel for miles in cathedrals or large and empty rooms before dying away. This process takes some time, and

instruments. In many cases the amount of energy expended is only small, and as the process is usually very inefficient, the sound being only a small by-product, the actual power of the sound itself may be only trifling. For example, if we let a steel ball drop on a table, or clap our hands, only about 1 part in 1000 of the energy dissipated goes into sound. We can do better than this, however, in the case of motor horns, where the efficiency is of the order of a few per cent, being much the same for bulb and electric horns. The coil-driven cone type of loud-speaker used in domestic wireless sets has an efficiency of about 3 per cent, but this figure is raised to 30 per cent or more with the high-efficiency loud-speakers used for talking pictures.

The actual powers of some familiar sounds are interesting. The acoustic output of a motor horn ranges between about $\frac{1}{4}$ watt or less for a bulb horn and about 1 watt for a powerful electric type. An orchestra of 75 players has a normal output of about $\frac{1}{2}$ watt (the bass drum claiming some 60 per cent) which may rise to 50 watts in stirring passages. Sirens and fog horns attain figures in the region of a horse-power. By comparison the human voice is very weak, reaching in normal use only about 10 microwatts.

The measurement of the small energies possessed by most sounds is effected by a microphone and amplifier and a suitable indicator. The microphone is in principle similar to the mouthpiece of a telephone. Sound falling on either of these instruments causes a diaphragm to vibrate in time with the aerial waves, and these vibrations are arranged to generate electric currents which in turn vary similarly to the sound waves. In the measurement of sound, the electric currents are used as an indicator of the intensity of the sound, since their strength increases with that intensity, although not in exact proportion. The amplifier is only necessary because the currents are so feeble initially that they cannot be measured on an ordinary instrument without being amplified.

Complex sounds can be analysed into their spectra, so as to afford both the intensity and frequency of each component.

The Measurement of Loudness. Loudness is a quality solely determined by the ear. Experience shows that while loudness and energy are related, the two do not keep in step when the frequency is changed, so that an energy meter, such as a microphone, cannot be used as a direct measurer of loudness. The situation is met by establishing a reference scale of loudness obtained by operating a pure tone of specified frequency

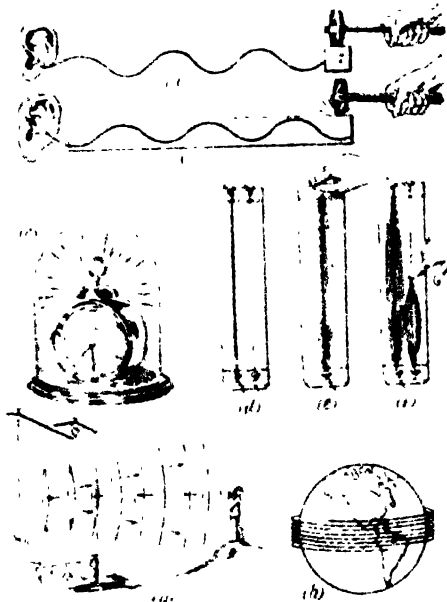


FIG. 3

(a) and (b) Sound travels better through dense material. (c) Sound in a vacuum is almost inaudible. (d) A thick string will give a lower note than a thin one. (e) By tightening a string the pitch is raised. (f) By shortening a string the vibrations increase and a higher note results. (g) The reflection of sound waves from an obstacle produces an echo. (h) While light travels at over 186,000 miles a second—more than seven times the distance round the world—sound travels at 1090 feet per second only.

the effect heard, termed "reverberation," is due to the continued succession of reflected waves which reach the ear.

The behaviour of the reflected waves cannot conveniently be studied in air, since they are invisible. There, is however, a great advantage in being able to predict the acoustic properties of a building before it is built, so that defects may be avoided from the beginning.

The Measurement of Sound. Man has developed very many and ingenious ways of making sound, for example in musical

by a progressive scale of measured steps of energy.

On the British Standard Scale the reference tone has a frequency of 1000 cycles per second and an arbitrary "zero" of energy near the "threshold" of hearing. If the reference tone is increased in successive *decibel* steps of energy above the zero, the resulting changes of loudness are expressed in numerically identical steps on a scale of *phons*. The equivalent loudnesses of other sounds are evaluated by matching them by ear against the suitably adjusted reference tone, the loudness number of the latter, in phons, then giving the loudness of the sound matched. It may be added that a "bel" represents a tenfold increase in energy, while each decibel signifies approximately a $5/4$ increase, two decibels a $(5/4)^2$ increase, and so on, ten decibels being exactly equivalent to a bel.

Echoes. Echoes (see Fig. 3) are examples of the reflection of sound from suitable objects in which the reflected sound lags behind the original sound by an interval of $1/4$ sec. or more. Echoes are very commonly observed in or near large buildings. Knowing the velocity of sound, we can readily calculate the distance of the reflecting object. The method of echoes from the sea bottom is frequently used as a continuous sounding-gauge by ships, a series of impulses being sent out, the time at which the echo is received being registered on a chronograph. For this, sound of very short wave-length is used, since it tends more to travel in straight lines and is thus less diffused.

Sound-proofing of Walls and Floors. The processes of the absorption and transmission of sound and noise are of social and industrial significance, and have received much scientific attention of late years. In particular the erection of large blocks of flats has directed attention to the question of sound-proofing walls and floors. In the case of walls, air-borne sounds, such as conversation or the wireless loud-speaker, are the chief things to be reckoned with. For such sounds the average degree of sound-proofing of single homogeneous walls is a question of the weight, no matter what the material. High notes are more easily arrested and absorbed than low notes.

In the case of floors, the chief nuisance is impact noises, such as footsteps. The best remedy is to introduce discontinuity or resiliency into the structure. In many cases rooms may be appreciably quietened by introducing absorbents, such as heavy carpets, curtains and upholstery.

SOUNDING. The process by which water depths are determined. The simplest sounding device is the plummet, a lead weight to

one end of which a stout cord is attached. It is thrown into the water, and as it sinks it draws the cord with it, which, being marked in feet, shows the depth. See **PLUMMET**; **LEAD**, **SOUNDING**.

The plummet was replaced by a diving rod, which is a hollow cylinder with valves at the top and bottom, opening and closing so that a specimen of the sea bottom may be carried up. For deep-sea and scientific purposes, a larger sounding machine has been developed. It consists of a device which carries nearly 6000 fathoms of wire rope, and is fitted with two brakes, one for holding the reel and the other for stopping it when the weights strike the bottom. As the wire passes over a registering wheel, the amount of wire run is indicated on a dial. A new type is the echo-sounder. See **SOUND**.

SOUND-RECORDING. Sounds are vibrations which travel at a speed of about 1100 ft. per second, and two factors make up the quality of a sound, the volume and the pitch, or frequency. This last is the number of vibrations per second producing the particular sound.

The full range of audibility lies between 16 and 20,000 cycles (vibrations per second) and even the most up-to-date methods of recording cannot cover anything like the whole of this range. Usually between 100 and 8000 cycles is the range reproduced. The human ear, however, is tolerant, and if given a sufficient percentage of sound will fail to note the absence of the remainder. This has materially helped in securing the widespread interest in the gramophone and the sound film.

Early Methods. The first success in the recording of sound was that of Leon Scott in 1857, and the tangible reward of his efforts was no more than a wavy line of smoked paper. No method was devised for reproducing sound from this record, and there the matter rested until in 1877 Thomas A. Edison achieved more practical success, recording sound on a cylinder covered with tinfoil, and reproducing sound from that record. This, however, was only a laboratory success, for the records wore badly and could only be used a few times. Further experiment proved wax to be a better medium than tinfoil, but here also wearing quality was poor.

The method of recording, briefly, was that the sound to be recorded had to be produced close to the mouth of a long trumpet, at the small, distant, end of which was a thin diaphragm to which was connected a cutter, or stylus, which rested on the tinfoil cylinder. The cylinder was rotated and drawn past the stylus so that this described a spiral course

on the tinfoil. The sound vibrations striking the diaphragm caused it to vibrate and so resulted in the stylus cutting into the tinfoil to varying depths. Reproduction from the record was poor, for the needle, which was supposed to follow exactly the path cut by the stylus and so to reproduce fluctuations, the duplicate of those caused by the sound striking the recording diaphragm, had a tendency to jump the "valleys" of the record and so to miss many sounds actually on the record.

Research continued and it was found that, from a master record in wax, copies could be made in a composition which could be hardened, and so would wear almost indefinitely. Largely due to the work of Berliner, cylinders gave place to flat discs which were easier to duplicate. This was a big step forward, but in 1924 an even bigger one followed.

Electrical Recording. Hitherto, every instrument had to be near the mouth of the recording trumpet, and the greatest difficulty was found in selecting the correct distance for each individual so as to get a moderate uniformity of quality without one instrument of an orchestra dominating the rest. With electrical recording, instead of the band going to the recorder, the microphone—or several of them if wanted—went to the orchestra and correct balance in records became much simpler.

Sounds striking the diaphragm of a microphone produce an electric current, fluctuating in proportion to the strength and frequency of the sounds. This current is passed to an amplifier which increases its power, and thence to an electro-magnet which pulls or pushes the cutting stylus. It has been found better for the stylus to be moved laterally, instead of vertically as in the earliest recordings, because the tracking needle of the reproducer can be forced to follow every bend in its path without jumping the "valleys" of the former type of record.

Foregoing paragraphs have dealt with the method of recording employed by the gramophone, and by various types of dictating machines, but this is by no means the only method used. Of almost equal importance, and perhaps of even greater potentiality, is the photographic method of recording which is now general with all sound films. This was invented in 1906 by Eugene Augustin Lauste and is described in the article *CINEMA* (Sound Films Explained). See also the section *The History of Sound* in the same article. Yet another method is in use: recording sound by magnetizing a metal wire or tape: a process due to Dr. Stille and introduced into this country by Louis Blattner. One of the

features of this process is that if a tape on which a record has been made is used for another recording, the second record obliterates the first and so enables a tape to be used again when the need for the recording on it has passed. Because records made in this manner do not require processing and can be played back immediately without damage to the record, the system is used extensively by the British Broadcasting Corporation.

From the figures given earlier in this article it is apparent that the range of present-day reproduction of sound recorded or transmitted by wire or wireless is comparatively small. It covers, however, the frequencies of the sounds most commonly used by man, and its shortcomings are apparent only to those whose sense of hearing is either exceptional or has been trained (as that of a skilled musician). That the standard already achieved is reasonable is shown by the remarkable popularity of the gramophone and of the sound film, and since electrical recording and reproduction have been employed practically for rather less than ten years, we may confidently look forward to further marked improvement in the near future.

SOUTH AFRICA, UNION OF. See *UNION OF SOUTH AFRICA*.

SOUTH AFRICAN WARS (1880-81 and 1899-1902). A struggle for supremacy in South Africa between the British government and two Boer republics—the South African (now the Transvaal) and Orange Free State.

First War. The Great Trek of the Dutch Boers from Cape Colony took place in 1836. In 1852, by the Sand River Convention, formal recognition of self-governing rights was accorded to the Transvaal, and in 1854 to the Orange Free State. Danger of Zulu attacks led by Cetewayo brought about the annexation of the Transvaal by Great Britain in 1877, and this was followed by an endeavour to federate the whole of South Africa. The Cape Parliament, however, rejected the idea of federation and, influenced by the Cape Dutch, favoured the independence of the Transvaal. In December, 1880, the Transvaal Boers declared their independence. Sir G. Colley led a force against the republicans, was checked at Laing's Nek, and a month later was defeated and killed at Majuba Hill. Fearing a Dutch rising in Cape Colony, Gladstone suspended military operations, recalled Sir Frederick Roberts, and in March, 1881, the Convention of Pretoria was signed, the Boers recognizing British "suzerainty" but retaining the right to manage their internal affairs. The Convention of London three years later modified this arrangement, and the word "suzerainty" was omitted.



DEVELOPMENT OF SOUND RECORDING

1. Early Edison phonograph, made about 1880. Recording was on tinfoil wrapped round the cylinder.
2. A partly worn needle (highly magnified); note the flattened side that damages the record.
3. Berliner gramophone of 1894. It used a laterally cut disk record and was driven by hand.
4. Spring-driven commercial model made by Berliner in 1897. This is the instrument in the trade mark of the Gramophone Company.
5. Sir Ernest Shackleton recording by the old mechanical (acoustic) method.
6. Experts examining a master record while it is being made. The wax shaved off by the stylus is drawn away from the record by suction.
7. Cross-section of a record, highly magnified.
8. Highly magnified surface of a record.
9. One of the Marconi-Stille steel tape recording and reproducing machines at Broadcasting House.
10. A film recording machine, employing the variable density method, with all its covers removed.

Photos: (1) the Gramophone Company; (2, 3, 4, 5, 6, 7, 8) Western Electric

Jameson Raid. In 1884 gold was discovered in the Transvaal, and the influx of Uitlanders served greatly to disturb the placid Boers. The latter, who believed that the foreigners hated them and would seek to gain political control of the government, put forth every effort to check such a plan. Under the leadership of their President, Paul Kruger, they so modified the naturalization laws that, in 1887, the term of residence necessary for securing citizenship was fixed at fifteen years. The foreigners, encouraged by Cecil Rhodes, protested against this and other severe restrictions. The rights implied in "suzerainty" were unfortunately ill-defined and a trial of strength seemed inevitable. Dr. Jameson raised an armed force consisting of troopers of the Chartered Company of British South Africa and, expecting support from a rising in Johannesburg, on 31st December, 1895, he prematurely crossed the frontier. The raid was a total failure, and two days later Jameson was forced to surrender ignominiously.

Second War. Negotiations between the Government and the South African Republic failed to secure a peaceful solution of the difficulty, and in October, 1899, war was declared, the Orange Free State joining with its sister republic against the British. At the outbreak of hostilities, an army of 12,000 British troops was stationed in Natal, and small detachments were posted at Kimberley, on the western frontier of Orange Free State, and on the Bechuanaland

and Rhodesian borders. The Boers swarmed into Natal and shut up a British force under Sir George White at Ladysmith. The English troops under General French (later Earl of Ypres) checked the Boer advance into Cape Colony, and Lord Methuen opened the way to Kimberley. The British then met with a series of discouraging reverses, but in January, 1900, reinforcements arrived under Lord Roberts, Lord Kitchener acting as his chief of staff.

A new campaign was immediately begun. On 27th February, the Boer General, Cronje, surrendered to Lord Roberts at Paardeberg in Orange Free State, and the following day a final and successful attempt raised the siege of Ladysmith. British advances were made in the northern part of Cape Colony, and on 13th March Lord Roberts entered Bloemfontein, the capital of Orange Free State, and the Republic was proclaimed British territory. In May, after a siege of 218 days, Mafeking was relieved.

After encountering the Boers under General Louis Botha on the Vet River, Lord Roberts crossed the Vaal and entered the city of Johannesburg on 31st May. Five days later, he took Pretoria, the capital of the South African Republic, and President Kruger fled. British forces in Natal pushed north, driving the Boers before them, and united with Lord Roberts in a drive against General Botha, who surrendered on Portuguese territory in September, 1900.

The rest of the struggle was characterized



A SCENE DURING THE BOER WAR: "CREEVYOT LONG TOM" IN ACTION AT LADYSMITH

Photo: Topical



REMINISCENCE OF THE BOER WAR

Bullock wagons loaded with material captured from a Boer laager crossing a drift near Paardeburg.

Photo: Topical

by guerilla warfare. The British adopted the methods of blockhouses, cattle raiding, and crop burning, to enforce surrender which was made in May, 1902. The Boer forces did not exceed 95,000, while the British forces numbered nearly 200,000.

By the terms of peace signed at Pretoria, 31st May, 1902, the two Boer Republics were annexed to the British Empire. Civil administration was to succeed the military government as soon as possible, and be followed by representative government; the Afrikaans, the Boer language, was to be allowed in courts of law and be taught in schools. Since 1910 the Transvaal and Orange Free State have been provinces of the Union of South Africa.

SOUTH AMERICA. A continent in itself, connected by the Isthmus of Panama with North America. The two continents form what is known as the New World.

Size and Situation. Like North America, the southern continent is irregularly triangular in shape, with its widest extent in the north and the apex in the south. It has an estimated area of 7,700,000 square miles, and occupies nearly one-seventh of the total land area of the globe. Its greatest length, from Punta Gallinas to Cape Horn, is about 4800 miles, and its greatest width is 3300 miles. It extends about 1000 miles nearer to the

South Pole than does Australia, which is considered the southernmost continent.

The People. South America's 81,000,000 people represent a number of races. There are, first, the descendants of the native Indians. The Spaniards and the Portuguese married Indian women, and this intermarrying produced a race of half-breeds, or *mestizos*. By far the greater proportion of the inhabitants of South America belong to this race of mixed blood. Later on, negroes from Africa were brought as slaves, and these by intermarriage contributed yet another strain of blood. Of late years, numbers of Italians and Spaniards have emigrated to the continent, settling particularly in Argentina. A number of Germans, British, and citizens of the United States live in the large towns. Spanish blood, language, religion, and culture, however, predominate in every country except Brazil, which is Portuguese in these respects.

Physical Features. The most striking feature, as in North America, is the great mountain system that extends along the western coast, forming, as it were, the backbone of the continent. This mountain system is known as the Andean Cordilleras, or Andes. Next to the Himalayas in Asia, it is the highest mountain range in the world.

The Andes, especially in the region around

the equator, contain several active volcanoes. These are Chimborazo, Cotopaxi, Antisana, Camyambe, Maipu, and Sangay. This region is subject to frequent and violent earthquakes. Other peaks such as Sorata and Illimani are non-volcanic. Between the Andes and the Pacific Ocean, there exists in most parts a narrow plain, which has an average breadth of 40 miles and a maximum breadth never exceeding 100 miles. Much of this area is arid desert, merging toward the extremities of the continent into forest lands.

To the east of the Andes extends the great central plain, which is bordered on its eastern side by highlands known as the Brazilian plateau.

The Andean Cordilleras are folded mountains of Tertiary age, and lie in the main in two ranges which have no low passes. Between them, where they separate in the middle latitudes of the continent, lies the high plateau of Bolivia at an elevation of some 12,000 ft. A low, worn-down coast range belonging to the same mountain system appears in many parts on the Pacific plain, but in the south has been separated by submergence and forms many islands. The Brazilian plateau is the oldest part of the continent and belongs to the same old crystalline rocks as the plateau of Africa. It is highest near the coast where it rises to 10,000 ft. in the Serra do Mar, but its general level is between 2000 and 5000 ft. The Guiana plateau, of the same nature and age, has been separated by the action of the Amazon in cutting a deep wide valley. The Patagonian plateau, less elevated, is of younger age and flanks the Andes on the east. The central plains are extensive, occupying about half the continent and extending from the Caribbean Sea to Patagonia. In the north and central parts they tend to be swampy and forested. Further south they form the Chaco, and still further south the level pampas of the Argentine.

With the exception of the southern part of the west coast, which is indented by numerous fjords and is bordered by islands, the coast-line of South America is remarkably regular. On the west are the Plata estuary and the navigable Amazon.

The few islands belonging to the continent include Trinidad, off the northern coast, Tierra del Fuego, separated from the mainland by the Strait of Magellan; the Falkland Islands, east of the southern extremity of the continent; and the Galapagos Islands on the equator, west of Ecuador.

South America contains the largest river system in the world—the Amazon—which drains nearly one-third of the continent. To the north of the Amazon is the Orinoco River, and to the south is the Plata. Among

the other important rivers are the Tocantins, the São Francisco, the Magdalena, the Parana, the Paraguay, the Uruguay, the Rio Negro, and the Colorado, all of which flow into the Atlantic. Because of the nearness of the Andes to the coast, the rivers flowing into the Pacific are short.

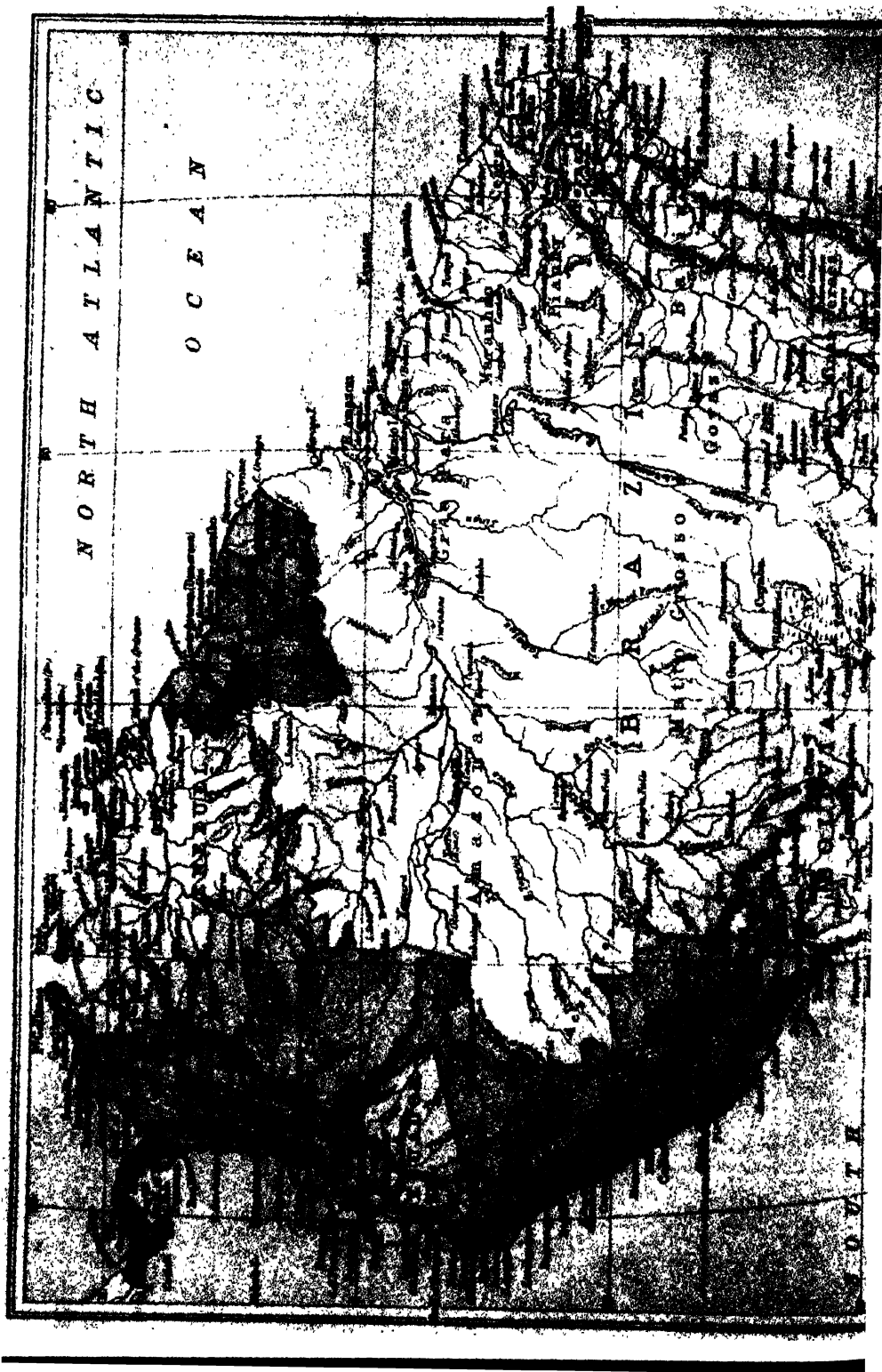
The largest lake is Titicaca, situated in the Andes between Bolivia and Peru. It covers an area of about 3200 square miles.

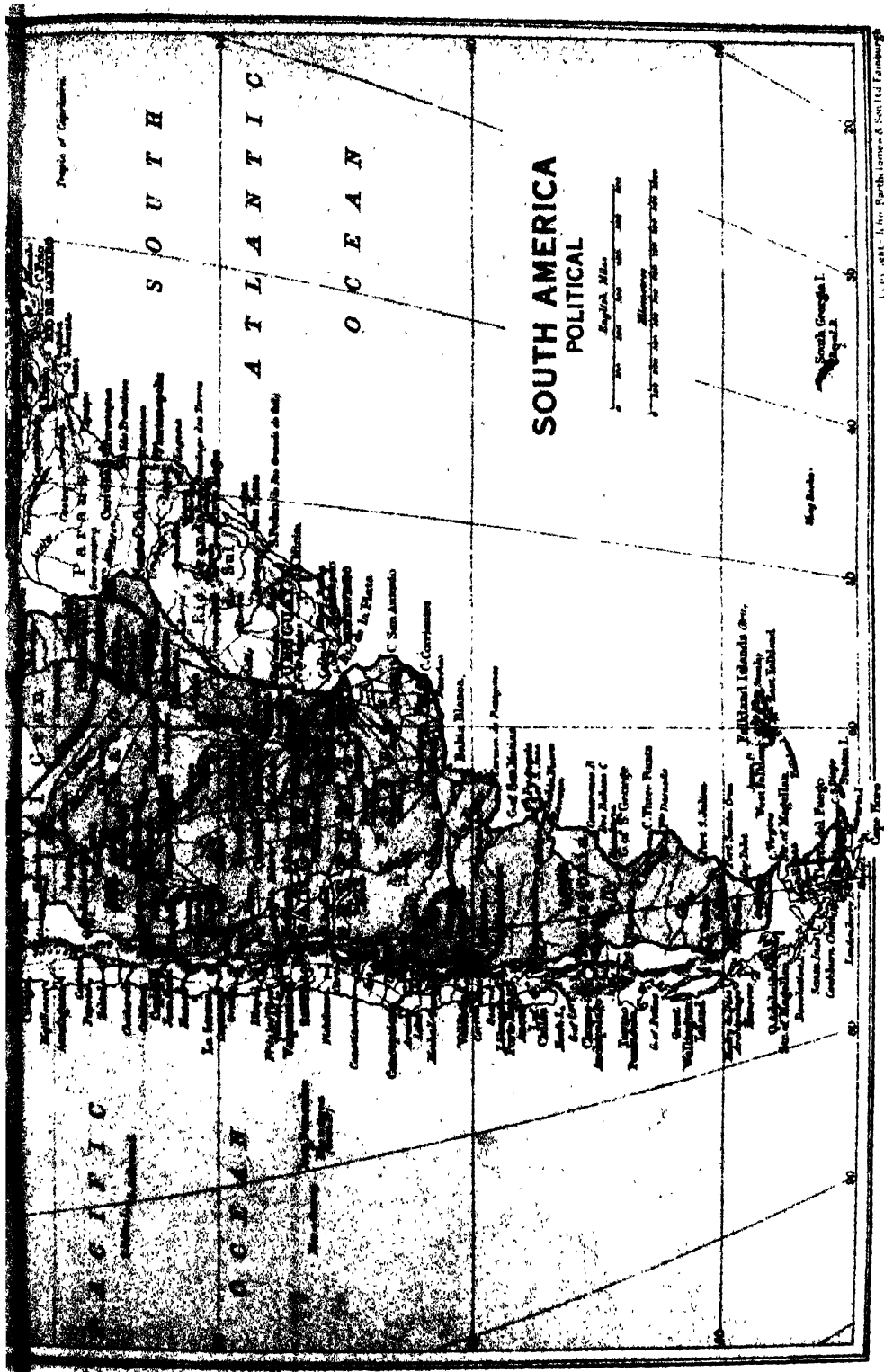
Climate. All of the continent north of Rio de Janeiro lies within the tropics, while the southern portion is in temperate regions. The temperature during midwinter averages about 80° Fahrenheit in the north and 35° in the south; during midsummer it averages about 85° in the north and 50° in the south. The lowlands along the Orinoco and the Amazon and the coast of Brazil have a hot climate and a high degree of humidity. The seasons are, of course, opposite to those in the northern hemisphere, summer occurring in December, January, and February, and winter in June, July, and August. The rainfall is heaviest on the tropical coastlands and in the Amazon basin, where it averages 50 to 75 in. a year. It diminishes gradually toward the south, merging into the arid region of Patagonia, constituting most of the southern half of Argentina.

Vegetation. The vast tropical region of the north is covered with a luxuriant vegetation representing a large number of species. Characteristic of this region are the tropical forests called *selvas*, which extend through the whole valley of the Amazon. These forests contain giant trees laced together with a drapery of lianas, creepers, and all sorts of twining and climbing plants, while the ground under them is covered by a thick undergrowth or jungle. In the sub-tropical regions, the chief trees are palms, bamboos, cedars, mahogany, and ebony trees, while the mountains are covered with conifers, mostly South American pines. South of the Amazon Valley extends the forested plateau of Matto Grosso, whose name means "great woods," and south of this is the region known as the Gran Chaco of Parana, where the wax palm is the typical tree. A native plant of this region is a holly, from the leaves of which a beverage called *maté*, or Paraguay tea, is produced. In southern Chile forests of beech prevail. In temperate parts of Uruguay and Argentina there are extensive grasslands.

Among the valuable tropical trees of South America are the Para rubber tree, the cinchona (from which quinine is extracted) on the eastern slopes of the Andes in Bolivia, Peru, and Ecuador, and the coca tree (the source of cocaine), found in the tropical valleys of the Andes. Cotton, tobacco, rice,







SOUTH AMERICA POLITICAL

English Miles
0 100 200 300 400 500 600 700 800 900 1000
Kilometers
0 100 200 300 400 500 600 700 800 900 1000



coffee, and sugar cane have been introduced and thrive.

Animal Life. South America is noted for the profusion and variety of its animal life. It not only contains a great number of species, but many that are not found on any other continent. On the other hand, some of the commonest animals, such as wolves, are not found there. There are several families

The tropical regions are a jungle paradise not only for wild animals, but for gorgeously plumed birds, including humming birds, flamingoes, toucans, tanagers, chatterers, and a great variety of parrots. The largest bird of prey in the world, the condor, is found in the Andes. In the tropical regions, insects also are numerous, and include many species of large and brilliant-hued butterflies. Chief



THE SNOW CREST OF CHIMBORAZO

Once thought the highest peak in the New World, this volcano rises 20,498 feet. The perpetual snow cap extends for half a mile down from the summit.

Photo: U. & U.

of monkeys, two of which differ from those of the Old World. A group of mammals peculiar to this continent consists of the toothless animals, such as the bloodsucking bats, sloths, ant-eaters and armadillos. The largest of the native mammals is the tapir.

The most powerful of the flesh-eating animals is the jaguar, which is the only formidable beast of prey on the whole continent. Almost all of the wild animals so abundant in Asia and Africa are missing, but there are found such animals as the llamas and the vicuñas, which are relatives of the camel. Horses, cattle, sheep, and goats were not among the native animals of South America, but were introduced from Europe.

among the reptiles are alligators, boas, rattlesnakes, and turtles.

Mineral Resources. In Bolivia, silver has been of importance, but the output is now declining. The same applies to the gold of Brazil. Colombia, Venezuela, and Guiana also have deposits of gold and silver. Other minerals which are found abundantly in South America are nitrate, especially in Northern Chile; borax and tin in Bolivia; manganese, iron ore, mica, and diamonds, in Brazil; and platinum, emeralds, and copper in Colombia. The petroleum production of Venezuela is exceeded only by that of the United States and the U.S.S.R., and Colombia, Peru, and Argentina also produce large

quantities of oil. Coal and lignite are mined in Colombia, Venezuela, Chile, and Peru, but on the whole South America has poor coal resources.

Exploration and Settlement. During his third voyage of exploration in 1498, Christopher Columbus discovered the island of Trinidad and sighted the mainland at the mouth of the Orinoco. During his fourth voyage, from 1502 to 1504, he coasted along the continent from the peninsula of Yucatan to the Gulf of Darien. The next navigator to explore South America was Alonzo de Ojeda, a Spaniard, who followed the coast from near Surinam to Venezuela in 1499. He was long thought to have been accompanied by Amerigo Vespucci, on the evidence of the latter whose name was given to the two continents. In 1500, Pinzón sailed along the eastern coast into the mouth of the Amazon, and then continued south until he had reached 8° 20' S. latitude. He was followed soon after by Cabral. Vespucci in 1503 probably went south as far as the Plata River. All were more interested in overcoming this huge land obstacle, which blocked a direct route to India, than in the character and resources of the new continent, with all its unknown wealth. Balboa, in 1513, crossed the Isthmus of Panama and discovered the Pacific Ocean, and Magellan, seven years later, in the strait that bears his name, at last found a route to the East.

The interior of this vast continent began to interest the explorers after some of the essentials of the coast line were known. Pizarro conquered the ancient Inca empire in Peru in 1531-1534, and his companions Almagro and Valdivia advanced farther south into Chile. Orellana crossed the Andes and, following the course of the Amazon, which Pizarro had discovered, from its headwaters to its mouth, reached the Atlantic Ocean in 1541. Spain and Portugal had almost entire control of the continent until the beginning of the nineteenth century. The Spanish colonies declared their independence, beginning in 1810, and established several republics after the model of the United States. After a protracted struggle, Spain formally recognized their independence in 1826. In 1823 Brazil became independent of Portugal and retained a monarchical form of government which lasted until 1889, when a Republic was established. The only areas still under European control are the British possessions of British Guiana, Trinidad and the Falkland Islands, Dutch Guiana and French Guiana.

Scanty population, lack of transport and dominance of tropical conditions have all

played a part in the slowness of economic development of South America.

SOUTHAMPTON. A County Borough and port with an area of 9192 acres and a population of 176,025 in 1931. It is an ancient town whose origin is found in the Roman fort Clausentum, built to protect the mouth of the Itchin. In Saxon days it was known as Hantune, when it was the chief port serving the Saxon capital of Winchester, and later it became the second town of Wessex. In the tenth century a royal mint was in operation there. Under the Normans it advanced as a port, and the first Charter of Incorporation was granted by Henry I. By decrees of Henry VI it attained the



OLD TOWN WALLS AT SOUTHAMPTON
Photo: George Long

status of a county. Its modern importance dates from 1840 to 1842 since when, aided by its four tides, it has grown to be one of the three most important shipping centres in England and the chief port of call for Atlantic liners. In connection with the docks, Southampton has become a centre for the building of ships, yachts and motor-boats, and for the construction of flying boats. The town's antiquities include much of the Norman walls, the Bar Gate with the Guildhall above it, and the arcades—arches built on to the old town wall and dating from the fourteenth century, the purpose of which was apparently to strengthen the existing wall following the French attacks. For the "County of Southampton," see HAMPSHIRE.

SOUTH AUSTRALIA. A state of the Commonwealth of Australia with an area of 380,070 square miles.

Most of the south and east is a plain area, sinking to below sea level in the Lake Eyre region, which is part of the great artesian basin of eastern Australia. Down-faulting has been responsible for the inlets of St. Vincent and Spencer Gulf and the basin of Lake Torrens, while up-faulting has



SOUTH AUSTRALIA

1. Smelting works at Port Pirie, Broken Hill. 2. Blossom time near Brighton, Adelaide. 3. The Anglican Cathedral, North Adelaide, seen from "Carclew." 4. On the Onkaparinga River, near Noalunga. 5. Vineyards in Chateau Tanunda. 6. A sheep farm in the Southern District.

Photos: South Australian Government

produced the Lofty Range (2000 ft.) and the Flinders Range (3490 ft.), which are outliers of old crystalline rocks among newer rocks. The Gawler Ranges of the south are part of the old Archaean plateau of Western Australia, which fills the western half of the state and rises to 5000 ft. in the Musgrave Range in the north-west.

The rivers, except the Murray, are of little importance. The Murray has 250 miles with the state territory, but it is of little value for navigation. The lakes lack much value. Lake Eyre is largely a salty swamp, half dry except after heavy rains. Lake Torrens has much the same character.

Climate is warm and dry. Adelaide ranges from 52° to 74° in the course of the year. The interior is hot. Rainfall along the coast is about 20 to 40 in. a year, most of which falls in winter. Towards the north there is a rapid decrease, and over 80 per cent of the state has less than 10 in. Scrub and steppe cover much of the interior, where drought often occurs, but the south is fertile and arable. The southern mountain ranges are forested.

People and Education. The census of 1935 reported 584,815 people. The larger part of the inhabitants are of British or Australian birth; other Europeans include Germans and Scandinavians. Aborigines number only about 3000.

Education is free, secular, and compulsory. Much attention has been given to agricultural and technical training. The university at Adelaide was founded in 1874. A state training college for teachers, a school of mines, and an agricultural college also exist.

Resources and Commerce. On the eastern side of St. Vincent Gulf and especially on the Adelaide plain there are over 50 per cent of the population of the state. Nearly half the state is arid and unoccupied, though the sinking of artesian wells (now about 150) in the north-east and in the Murray basin has brought some arid land into use. In the south-west, only brackish water is available. Sheep are far more important than cattle. They are mainly in the south, but are far less numerous than in New South Wales. Their chief product is wool. Cattle are found in the Adelaide plain and elsewhere in the south, but their products enter little into export trade. In the arid interior, camels are bred and used for transport. Of the cereal crops, wheat is most important and is grown chiefly round St. Vincent Gulf and on the east of the Spencer Gulf. About one-fifth of the Australian crop comes from this state, and wheat and flour come next to wool in value of exports. Two-thirds of Australia's barley, chiefly for malting, and some oats are grown. The Murray River is

important in the irrigated areas, and the acreage is half Australia's total. Under a system of bounty there is much production of wine. Citrons and other fruits flourish.

There is much mineral wealth, although mining up to the present is unimportant. Gold, first found in 1846, occurs in several places, but the production is very small. There is much copper ore, but in recent years production has very considerably fallen. In iron-ore the state is the chief producer of the Commonwealth from the haematite mines of Iron Knob; salt is obtained from evaporated sea-water; and opals and gypsum are of some importance. Coal, of poor quality, is not worth working.

There are flour-mills at the wheat ports, Port Pirie, Port Lincoln and Wallaroo, textile mills at Adelaide and some engineering in the same town. The lead smelters of Port Pirie use the ores of Broken Hill in New South Wales.

The 3800 miles of railway are scarcely adequate to serve all parts of the state. The total includes 600 miles of the Transcontinental line linking Fremantle with Brisbane and 600 miles of the Federal Transcontinental line to the north, which crosses the state and reaches Alice Springs in Central Australia. Wool and wheat are the principal exports by sea.

History. In 1802 Flinders discovered Spencer Gulf and St. Vincent Gulf, and in 1830 Stuart descended the Murray River to the sea. Eyre in 1840-41 travelled from Adelaide to Western Australia. After several attempts, Stuart crossed from Adelaide via the heart of Australia to the north coast in 1862. Giles in 1872 and 1875 explored the interior. It was the work of Stuart that first drew attention to the possibility of colonization in that part of Australia. Edward Gibbon Wakefield advocated a plan of colonization which he thought would result in the settling of new lands. His idea was that persons who were willing to work and improve a new land should be allowed to own it. In 1834 an Act of Parliament sanctioned the plan.

Colonization began in 1836. During the first few years, over-expenditure caused the colony to become insolvent. In 1841 the charter was revoked, and the settlement was made a crown colony. The discovery of valuable mineral deposits and the excellent management of the new Governor, Sir George Grey, again put the colony on a sound basis. In 1856 self-government was restored and a constitution was framed which provided for a bicameral legislature. In 1901 South Australia joined the Commonwealth, to which, ten years later, it ceded Northern Territory, which is considerably more than

half the original area of the state. South Australia is noted for its progressiveness in labour and social legislation.

The State Governor, who is appointed by the King, is assisted by an Executive Council of six Ministers and the Chief Justice of the Supreme Court. There is a Parliament consisting of the legislative council and the house of assembly. There is universal suffrage, the vote having been extended to women in 1894.

For Adelaide, the capital of South Australia, see separate article.

SOUTH CAROLINA. A state of the American Union with an area of 30,989 square miles. In 1930 the population totalled 1,738,765, of whom 793,681, or 45.6 per cent, were negroes. Charleston and Columbia are the only cities having a population of over 50,000. Other cities of importance are Greenville and Spartanburg.

South Carolina is for the most part in the Coastal Plain and Piedmont Plateau regions, extending into the Blue Ridge Mountains in the north-east. There are large areas of swamp and much pine forest. Until recent years the only crop of importance was cotton. Between 1917 and 1921, the spread of the boll weevil over the state awakened

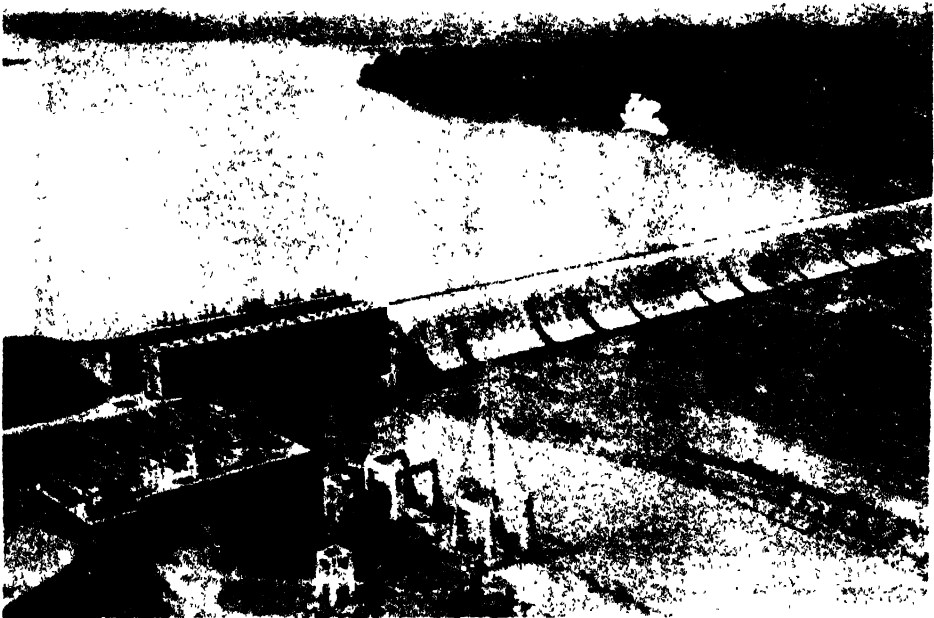
the cotton-growers to the evils of the single crop. To-day the general farm, with dairy cattle, some pigs, poultry, and bees, and several crops instead of one, is replacing the old farm where formerly only cotton and maize grew. Tobacco, oats, wheat, and rye are important cereal crops. Rice and many varieties of fruit are cultivated in the uplands. About one-fourth of the area of the state is woodland, made up largely of pine, cypress, and hard-woods. The numerous bays and salt-water creeks of the coast contain extensive oyster beds.

The abundant hydro-electric power afforded by the rivers has stimulated the development of industry; the predominant interest is the weaving of cotton goods, in which South Carolina ranks third among states of the Union.

SOUTH DAKOTA. A state of the American Union with an area of 77,615 square miles and a population of 692,849 (1930).

South Dakota is an undulating plain, rising from the level prairie region of the east to the rough plateaux and buttes of the Black Hills in the south-western part. The latter are the "bad lands" of the state, though much improved by irrigation.

West of the Missouri, which crosses the



DAM NEAR WATEREE, SOUTH CAROLINA

It is part of the system of harnessing the large water power resources of the district.

Photo: P. & A.



BRIDGE OVER THE MISSOURI RIVER AT YANKTON, SOUTH DAKOTA

centre of the state from north to south-east, the rivers flow eastward; east of it, they drain mainly toward the south. South Dakota is pre-eminently an agricultural state. The abundance of sunshine, the rich soil, and the plentiful rainfall of the eastern river valleys are all favourable to the production of big crops of wheat and maize. Other cereals raised in large quantities include oats and barley.

The Black Hills region, with its sheltered valleys here and there, produces a variety of crops and fruits. On the rougher areas and in the wooded reserves, grazing is important. This also constitutes one of the most valuable gold districts in the United States.

Manufacturing is closely related to agricultural pursuits, and is as yet of comparatively small importance.

SOUTHEND-ON-SEA. The second largest seaside resort in Great Britain, the Municipal and County Borough of Southend is situated in the county of Essex, on the north bank of the mouth of the Thames estuary. It is often called a suburb of London, being only 35 miles distant, and rail connection (L.M.S. and

L.N.E.R.), road and steamer services are very good. The population in 1931 was 120,093. The town, which faces due south, possesses beautiful wooded cliffs and many other attractions for the visitor. The northern bank of the Thames has been peopled from remote times, and there is evidence of successive occupation by Celts, Romans, Saxons, and Danes. The parishes now comprised within the county borough—Prittlewell, Leigh-on-Sea, Southchurch, Shoebury, and part of Eastwood—are all mentioned in



SOUTHEND-ON-SEA

Top: The pier and children's bathing pool. Bottom: A general view of the esplanade.

Photos: Southend-on-Sea Corporation



THE "BAD LANDS" IN THE BLACK HILLS OF SOUTH DAKOTA

Photo U' and U.

Domesday Book. Several battles have been fought in the district, and there are remains of castles and priories. Southend possesses the longest pier in the British Empire—1½ miles in length. There are farming, fishing, radio manufacturing, timber moulding, and other industries, but the chief "industry" is the catering for holiday-makers.

SOUTHERN CROSS. A constellation in the southern hemisphere, so called from the outline formed by its four brightest stars. The southernmost star is of the first magnitude, the eastern and northern stars of the second magnitude, and the western star of the third (see **MAGNITUDE**). The upper and lower stars, forming the upright of the cross, are the pointers to the South Pole. The constellation is also called *Crux*.

SOUTHERN UPLANDS. See **SCOTLAND**; and the individual counties.

SOUTHEY, *suth' i*, ROBERT (1774-1843). An English poet and prose writer, associated with Wordsworth and Coleridge in the Lake School of English Poetry. He was born at Bristol and educated at Westminster School and at Oxford. In 1795 he married Edith Fricker, a sister of the lady who later became Coleridge's wife, and soon afterward went with his uncle to Portugal.

After his return to England, Southey established himself with his wife at Keswick in the Lake District. Here he devoted himself to study and to the production of his numerous and varied writings. In 1807 the government granted him a pension of £144 a year. Early in his life, Southey had been a pronounced radical in politics, as in religion; as he grew older, he became more and more conservative, and in 1813, when he was appointed poet laureate, he was a staunch Tory. In 1837 his wife died, after a period of insanity, and two years later he married Caroline Bowles. Soon after his second marriage, his mind began to weaken, and he did not recover from the ailment.

Among his poems are *Joan of Arc*, *Thalaba the Destroyer*, *Madoc*, *The Curse of Kehama*, and *Roderick, the Last of the Goths*, all narratives based on legends and myths. He also published his *Vision of Judgment*, written in honour of George III, which occasioned Byron's brilliant satirical poem of the same title. Some of his prose writings are a *History of Brazil*, the *Letters from England* by Don Manuel Alvarez Espriella, *The Doctor*, and biographies of Nelson, Wesley, and Bunyan.

SOUTH GEORGIA. A mountainous, heavily glaciated island of about 1000 square miles, lying between lat. 54° S. and 55° S. in the S. Atlantic Ocean. Mount Paget rises to 9200 ft. The coasts are deeply indented and

afford several good harbours, but there are many outlying rocks and reefs. Winter is a period of continual gales with cloud, rain and snow, but the temperatures do not fall very low: summer is short and cool with occasional warm days. Vegetation is very scanty and confined to ice-free areas near the coast, where tussock grass and mosses thrive. Seals and sea birds breed round the coasts. There is no native population, but in recent years whaling has caused a few settlements on the north coast which, as a rule, are busy in summer but closed down in winter. This whaling population was, in 1926; 1895, chiefly Scandinavian, but had fallen by 1933 to 650 owing to over-production of whale oil.

The island is thought to have been sighted by Vespucci in 1502, and was seen and claimed by Cook in 1775. It is now one of the dependencies of the Falkland Islands. Sir Ernest Shackleton was buried here in 1922.

SOUTH ORKNEYS. A group of two principal islands and several small ones, lying in lat. 61° S. on the edge of the Antarctic, some 600 miles south-east of Cape Horn. They are mountainous and almost entirely ice-clad. Coronation Island rises to 7200 ft. and Laurie Island to 3080 ft. Moss and lichen are the only plant life; seals, penguins and other sea birds abound. The islands were discovered by Powell in 1821 and explored by Weddell in 1823, Bruce in 1903-04, and the R.S.S. *Discovery II*. Only explorers and an occasional whaler visit them. The islands lie within the British area of the Falkland Islands dependencies.

SOUTH POLE. See **POLE**; also **ANT-ARCTICA**.

SOUTHPORT. On the coast of Lancashire, about midway between Liverpool and Preston, is the seaside and health resort of Southport. It is a County Borough with a population of 78,927, and is served by the L.M.S.R., the L.N.E.R., and the Cheshire Lines railway. The town has developed on "garden city" lines and its floral beauties are well known. There are many parks and open spaces. Lord Street is generally considered to be one of the finest thoroughfares in Europe; nearly one mile in length, it has an average width of 72 yards. Southport is also famous for its golf courses, of which there are six within the borough boundaries.

SOUTH SANDWICH ISLANDS. A group of uninhabited volcanic islands in the South Atlantic Ocean. Of the eight islands lying in a north-and-south line, several are active volcanoes. There is no vegetation. The climate is cold and wet throughout the year. The group was discovered by James Cook in



NATIVE HOME IN TAHITI
Photo: Union Royal Mail Line

1775 and visited at later dates by Bellingshausen and other explorers. *Discovery II* explored the group in 1930. They are nominally a dependency of the Falkland Islands.

SOUTH SEA ISLANDS. Not a recognized geographical term, but a common name applied to the vast number of islands which dot the Pacific Ocean. See PACIFIC ISLANDS.

SOUTH SHETLANDS. An Antarctic archipelago lying off Graham Land about 450 miles south-east of Cape Horn. It includes six or seven larger islands and many islets, all being mountainous and heavily glaciated. Smith Island

rises to 6800 ft. The climate is cool and windy in summer and cold and stormy during the long winter.

Mosses and lichens are the only vegetation. Deception Island, which is a partially drowned volcano, affords a harbour which is utilized as a whaling station in summer and abandoned in winter. The archipelago was discovered by Smith in 1819. It has been explored by Bransfield in 1820, d'Urville in 1838, de Gerlache in 1898, Norden-skjöld in 1902, Charcot in 1904 and 1909, and by others. The islands are part of the Falkland Islands Dependencies of Great Britain.



PALM TREES IN A SOUTH SEA ISLAND VALLEY
Photo: Union Royal Mail Line

SOUTH SHIELDS. The county borough of South Shields is a growing seaport at the mouth of the Tyne in the county of Durham, with a population of 113,455. It is served by the L.N.E.R. and is 9 miles from Newcastle and 275 from London. There are here evidences of Roman occupation, and many relics are collected in the Roman Remains Park. To-day the town is an attractive seaside resort as well as being industrially important for its collieries, ship-building and repairing, engineering, and many allied interests. At one time it was noted for salt, glass and chemicals. At Tyne Dock large exports of coal are handled.

SOUTHWARK. See LONDON.

SOUTH-WEST AFRICA. From 1884 to 1915 known as GERMAN SOUTH-WEST AFRICA; a territory lying between Angola on the north and the Union of South Africa on the south. It surrounds the enclave of Walvis Bay (374 square miles), which has been British since 1884, and includes Damaraland and Namaqualand. The area of South-west Africa is 317,725 square miles. However, for administrative purposes, the region to the north-east, comprising 10,573 square miles and known as Caprivi Zipfel, was assigned to the Bechuanaland Protectorate. The population in 1934 was about 266,930, including about 31,600 Europeans. Among the races are Hottentots, Bushmen and Bantu negroes. English, German, and Cape Dutch are all official languages.

Germany began to take possession of this region in 1884. The boundaries of the colony were fixed by treaty with Britain and Portugal in 1890. In 1903 a Hottentot tribe revolted, and the following year the powerful Herero nation rose in rebellion. This revolt was only subdued after three years' fighting.

German South-west Africa was conquered by Allied troops from South Africa in July, 1915, and in 1920 it was placed under control of the Union of South Africa by mandate of the League of Nations. The capital is Windhoek. (Population, 4000.)

Resources and Commerce. The coastal zone, extending inland about 60 miles, is sandy and barren, and is bordered by a wide belt of highlands, which rise gradually to an altitude of 3000 to 6000 ft. A small part of the eastern section is a sandy desert, forming part of the Kalahari Desert, but there are large areas of good grazing land.

The raising of sheep and cattle constitutes the chief source of wealth. Copper is mined, and since 1908 diamonds have been the chief export; they are found along the coast northward from the Orange River. In 1929 large fields of nitrate of soda were discovered. Gold, lead, vanadium, silver, and other minerals are also worked. The other chief

exports consist of wool, hides, fish, livestock, and ostrich feathers.

SOVEREIGN. Gold coin of value £1, and weighing 123.274 grains Troy. The sovereign is the standard monetary unit of Great Britain, its fineness being fixed at 916.66, or twenty-two carats. It was first issued by Henry VII in 1489; on its surface was stamped the figure of the King seated on the throne and dressed in his robes of State. At that time, the coin weighed 240 grains. When James I became King of the United Kingdom of England and Scotland, the sovereign was called a *unite*, to commemorate the union. Until 1816 Great Britain used both gold and silver as standards in its monetary system, but in that year gold alone was made the standard. See BIMETALLISM.

George III chose the sovereign for the unit of currency, and it was first issued in its present form in 1817. Half sovereigns were also coined at this time.

SOVIET, *so'vi et*. A Russian word meaning "council," referring to the local administrative committees that were organized throughout Russia after the Tsar was deposed. These local soviets, made up of representatives of workmen, soldiers, peasants, etc., became the real source of power in the country; their representatives formed the Central Soviet, which Lenin and Trotsky seized and used as the instrument by which they rose to power. The word has come into universal use, for, following the revolution of 1917 in Russia, the Union of Soviet Socialist Republics was formed, including Soviet Russia, officially termed the Russian Soviet Federated Socialist Republic, and a number of semi-independent states founded on the same model. See RUSSIA.

SOW. The female pig (which see).

SOW THISTLE. One of a genus of weeds belonging to the composite family and native to Europe. The common *sow thistle* grows to be 2 or 3 ft. tall, and has a branching stem, milky juice, and small yellow blossoms. In Northern European countries the peasants use the tops and leaves as a potherb.

Scientific Name. The botanical name of the common sow thistle is *Sonchus oleraceus*.

SOYA BEAN. See BEAN.

SPACE-TIME. See RELATIVITY, EINSTEIN'S THEORY OF.

SPAHLINGER, HENRY (born 1882). A Swiss bacteriologist, well known for his introduction of a new method of treatment of tuberculosis in man and animals. His vaccine requires more than a year for its preparation, and its value has not yet been fully investigated. Experiments have recently been carried out on a large scale in Northern Ireland, from which it is claimed that a

great advance has been made in the prevention of tuberculosis in cattle.

SPAIN. A Republic of south-western Europe, with an area of 190,050 square miles. Including the Canary and Balearic Islands, the area is 196,607 square miles.

The People. The Spanish are descended from the early Iberian inhabitants of the peninsula and the Celtic, Roman, Teutonic, and Moslem invaders. Yet there is literally no "Spanish race," for the people of Spain are divided into rather well-defined groups with different languages and customs. The Basques of the north would appear to be a people on their own with distinct racial and linguistic characteristics. The Catalans of north-east Spain, more French than Spanish in race and language, are ardent nationalists. The remainder are more or less racially related, with the Moorish strain more pronounced in the south, and the Celtic and Teutonic in the north. Spain's population in 1934 was estimated at 24,583,096.

Education. Spain's intellectual development has been slow, but an awakening interest in learning reduced the rate of illiteracy from 63.78 per cent in 1900 to 45.46 per cent in 1930. Compulsory education to the age of 12 was authorized in 1857, but the law was not strictly enforced. The high schools give preparation for the eleven universities of Spain, which are at Barcelona, Granada, Madrid, Murcia, Oviedo, Saragossa, Salamanca, Santiago, Seville, Valencia, and Valladolid.

Religion and Language. When the Spanish Republic was established in 1931, the ancient connection between Church and State was dissolved, and measures were taken to break the power of the church in the most Catholic country in the world.

The Spanish language is derived from the Latin. The Castilian dialect is the chief language of the country. The Catalan, which resembles Provençal, and the Gallego, which

is more like the Portuguese, are spoken in the eastern and northern provinces.

Principal Cities. Spain has a large rural population, but there are at least 40 towns each with a population of over 35,000. The largest cities are the capital, Madrid (which see) and Barcelona.

Barcelona, the capital of Catalonia, is the most important commercial and industrial centre of Spain, and has one of the few good harbours of the country. It is in the north-east, commanding the Mediterranean, and has played an important part in Spanish history. The chief manufactures are silk, cotton and woollen fabrics, and hardware; the chief exports are fruit, wine, olive oil, and cork. It is the administrative centre of the Catalan provinces. Population, 1,148,12 (1934).

Cádiz, one of the most important seaports of Spain, is 60 miles north-west of Gibraltar on the Atlantic coast. Trade in wine and fruits is large, though not as great as formerly. Population, 75,393 (1934 estimate).

Córdoba, formerly *Cordova*, an ancient Moorish city, important during the Middle Ages, is situated on the banks of the Guadalquivir, 86 miles north-east of Seville. The city was once a great commercial centre, but its importance has declined. Population, at the height of its old splendour over 1,000,000, is now 117,919 (1934).

Granada is an old Moorish city more noted for its past glories than its modern attainments. It lies 40 miles inland from the Mediterranean, in the foothills of the Sierra Nevada, at an altitude of 2195 ft. above sea level. What few manufactures there are consist of textiles, paper, leather, macaroni, and chocolate. Population, 180,574 (1934).

Malaga is a port situated along the south coast, 70 miles from Gibraltar. It is a resort for invalids. Though the city's trade has shown a decline in recent years, olives, a famous wine, raisins, lead, almonds, lemons,



SCENES IN BARCELONA

Left: In the "Spanish Village." Right: Plaza Cataluña.

Photo: Blue Star Line







GENERAL VIEW OF SEVILLE

Photo: George Long

grapes, and esparto grass are exported annually in large quantities. There are thriving establishments for making cotton and linen goods, pottery, soap, chemicals, iron products, sugar, etc. Population, 203,844 (1934).

Saragossa, or *Zaragoza*, a prosperous commercial city in the north-east on the

right bank of the Ebro, on the site of an ancient town of the Iberians. It was once the capital of the old kingdom of Aragon (which see). The city is a centre of trade for a fertile farming region. Population, 189,062 (1934).

Seville, or *Sevilla*, is on the Guadalquivir



ORANGE GROVES IN THE VALLEY OF THE GUADALQUIVIR

Photo: George Long

in the midst of a country of vineyards and orange and olive groves. Next to Madrid, it is the most flourishing city in art, literature, and university education in Spain. The Gothic cathedral is unique. Cigars, pottery, silks, machinery, chocolate, perfume, iron products, and other commodities are manufactured. Population, 238,727 (1934 estimate).

few easy passes except the Col de Perthus (950 ft.) in the east and the low route between the two ranges. Peaks rise to 10,998 ft. in Maladetta and 11,170 ft. in Perdu. On the south-east there are less conspicuous fold-mountains known as the Sierra Nevada rising in Mulhacen to a peak of 11,660 ft. There is little low-lying plain around the coasts except in the south-west, but that on



BOMB EXPLOSION AT THE WEDDING OF KING ALFONSO AND PRINCESS ENA IN 1907

Photo: Topical

Valencia, the third city in population, ranking next to Madrid and Barcelona, lies on the Guadalquivir, three miles from the Mediterranean. Valencia is noted for its silks, coloured tiles, tobacco, textiles, and iron and bronze wares, and carries on a thriving trade in oranges and other fruits. Population 352,802 (1934 estimate).

Physical Features and Climate. The Iberian peninsula as a whole is a plateau of ancient rocks at an elevation of 1000 to 3000 ft., on which lie several basins that represent old lakes. Each of these is now drained by a river to the west (Douro, Tagus, Guadalquivir, Guadiana) or to the east (Ebro). The intervening ridges form rugged sierras. In the north lie lofty folded mountain ranges of younger geological date. The Pyrenees and Cantabrians, as the ranges are called, have

the east, though narrow, is important. The rivers of Spain flow mainly west with the tilt of the plateau, but owing to lack of water are of little use for navigation, except the Guadalquivir, and to a less extent the Ebro.

Spain has not a true Mediterranean climate, for though it has hot, dry summers, the winter is seldom mild but rather notably cold. Rain, falling chiefly in spring and autumn, is scanty except in the north-west, which is wet throughout the year and escapes the winter cold. Most parts of Spain require irrigation for successful agriculture.

Agriculture. A large proportion of the inhabitants are engaged in farming, but methods of cultivation are generally crude. Although over 80 per cent of the land of



1. Bridge at Cordoba. 2. Castle near Seville. 3. General view of Granada. 4. Seville Cathedral.

Photos: George Long

Spain is regarded as productive, nearly one-third of the country remains uncultivated.

Irrigation is necessary in the central and eastern districts and in parts of the north-western provinces. The two most productive regions are in Valencia and Catalonia, where the land is carefully terraced, fertilized, and irrigated by a network of canals fed from reservoirs. Large crops of oranges, lemons, grapes, and other fruits are produced. Rice is grown extensively in the swamps in Valencia.

The most important crops of the country are wheat, barley, rye, oats, grapes, and olives. Vines are grown in every province, and large quantities of wines, especially the famous Malaga and Alicante, and the sherry and tinto wines from Jerez de la Frontera, as well as grapes and raisins, are exported. The olive groves cover hundreds of square miles. The silkworm is extensively cultivated, especially in the south. Spain is noted for its fine horses and mules and its merino sheep. Large flocks of goats are raised throughout the country.

Minerals. Though the vast mineral resources of Spain are in an early stage of development, no other country of Europe produces as much copper, lead, and mercury. The famous mercury mines of Almaden were once the richest in the world. These and the salt works are the only mining industries owned by the government. Iron ore is exported in large quantities. Zinc, manganese, cobalt, sulphate of soda, sulphur, and phos-

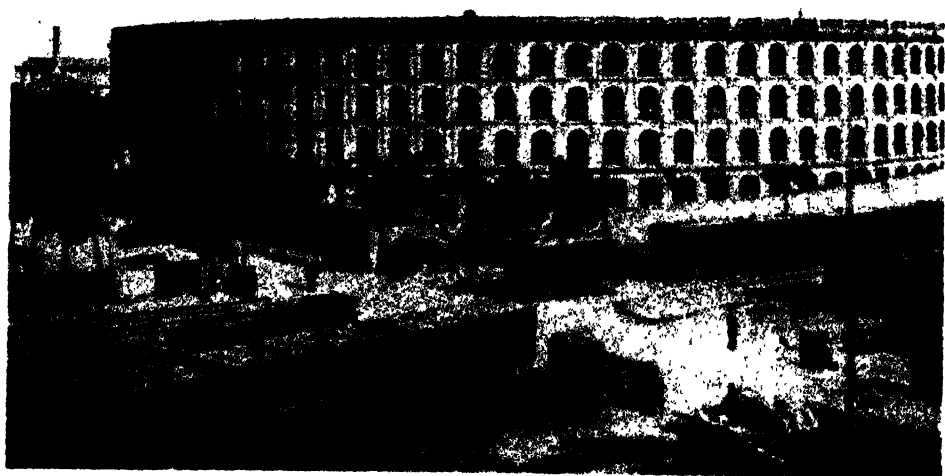
phorus are also found; coal for home consumption is mined.

Manufactures. The chief manufactures—cotton goods, woollens, and laces—are centred in Barcelona. Linen and paper mills are also numerous in the northern provinces. The weaving of silk is growing in importance in the south, and there are a number of glassmaking factories. The manufacture of sugar is on the increase, and a few new iron and steel plants have been set up. Seville and Barcelona make cork products.

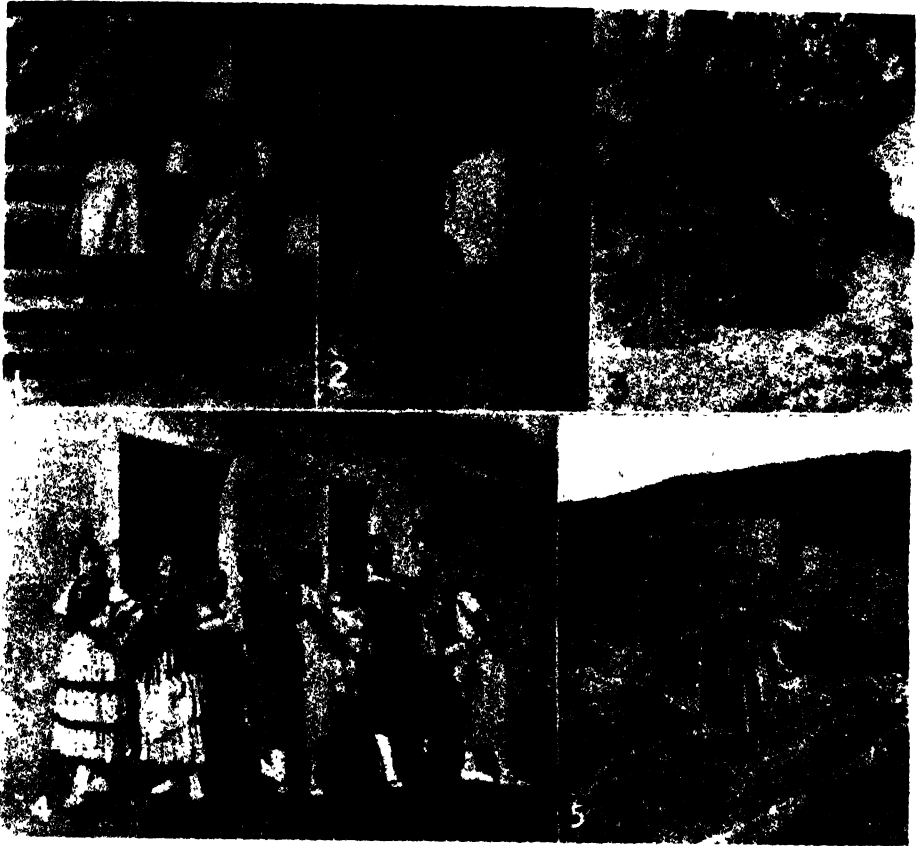
Transport and Commerce. There are 8500 miles of railways, all owned by private companies. The roads have been greatly improved of late years.

Although Spain has a long coast-line both to the Atlantic and to the Mediterranean, the country is not important among the commercial nations of Europe. Much of the trade is with Great Britain, France, the United States and Germany. The principal exports are wine, cork, metals, olives, and other fruits, animals, glassware, pottery, wool, and cotton goods. Foodstuffs, livestock, machinery, coal, raw cotton and linen, motor vehicles, and drugs and chemicals are imported. Barcelona, Bilbao and Cadiz are the chief ports.

Government. The Constitution of 1876 vested the executive power in the King and a Council of Ministers appointed by the King. The monarch was inviolable, but the Ministers were responsible to the Cortes or parliament which met annually in two



BULLFIGHT ARENA



SPANISH PEASANT TYPES

1. At a fountain in Santiago 2. By the Great Gate at Fuenterrabia, Northern Spain. 3. Gipsy women at a wayside shrine. 4. Dancers at Granada. 5. Harvesting wheat in the Northern Province of Guipuzcoa.

Photos. George Long; U. & U.

chambers, and signed all the King's decrees. The King had power to assemble, suspend, or dissolve the Cortes. The legislative authority was vested in the King and the Cortes.

Following the elections of 12th April, 1931, the monarchy was overthrown two days later. Although he did not abdicate, Alfonso fled from Spain. Zamora y Torres at once proclaimed a Republic, and was made provisional president. Far-reaching reforms were inaugurated, titles of nobility were abolished, and the King's property was confiscated. The Cortes began the work of making a new Constitution, which was completed in November. It provided for a President, elected for six years, and a single-chamber Cortes elected for four years. Church and State were separated. All men and women over 25 years of age may vote.

Colonies. Of its once extensive colonial possessions, Spain now retains only Adrar and Rio de Oro, on the Sahara coast; Spanish Guinea and Ifni, also on the west coast of Africa; and the islands of Fernando Po, Annobon, and Corisco and the Elobey Islands, all in the Gulf of Guinea.

The Three Conquests of Spain. This country, known to the Greeks and Romans as *Hispania* or *Iberia*, and inhabited by people they called *Celtiberians*, was visited in the twelfth century before Christ by the Phoenicians. The first real conquest of the peninsula was in the Second Punic War, when the Romans defeated the Carthaginians and made Spain a Roman province. Some of the finest Roman remains are at Merida. Later, Christianity became the dominant religion.



TRADITIONAL HOLY WEEK CEREMONIES IN SPAIN

Left: Members of a religious confraternity wearing the old penitents' dress.

Right: Part of a religious procession on Good Friday.

Photos: George Long; Topical

With the fall of the Roman Empire, Spain fell under the power of the three Gothic tribes: the Vandals conquered the south, naming it Vandalusia (now Andalusia), and the Suevi and Alans settled in Galicia and Portugal. By 573 the Visigoths had subjected these invaders and had conquered the whole peninsula. After a mastery of nearly two hundred years, they in turn were subjugated by the Moors in 711-712.



WOMEN OF SEVILLE WEARING BLACK
MANTILLAS

Photo: George Long

The Visigoths, driven into the north, had established the small independent kingdoms of Leon, Navarre, and Castile. The kingdoms of Galicia, Aragon, Murcia, and Portugal had been established as a result of the division of the small kingdoms among the sons of the kings. The civilization of Spain during this period surpassed that of most of the other European countries. In the thirteenth century, these Christian principalities united against the Moors, and

the Moorish princes were subjugated by Castile.

The Union of the Independent Kingdoms. Aragon and Castile continued to develop, and in 1469 Ferdinand V of Aragon married Isabella of Castile. Ten years later, these two kingdoms were united, and the fusing of the many independent states into a political unity was begun. The history of the next hundred years, during the reigns of Ferdinand and Isabella, Charles V, and Philip II, is one of continued success and added glories.

During the period of expansion, the Moors lost their last stronghold at Granada. The discovery of America, under the patronage of Isabella, extended the kingdom abroad. Mexico, Central America, Peru, Venezuela, Chile, Cuba, Jamaica, and Santo Domingo were acquired; conquests extended to Africa and to Malacca and the Spice Islands in Asia, and, with the acquisition of the Philippines, the Spanish Empire girdled the globe. The European conquests included Navarre, Roussillon, Portugal, the Netherlands, Naples, Sicily, Sardinia, the Canaries, and the Balearic Islands.

The Decline of Power. Spain's glory did not last long. In 1588 the naval supremacy of the kingdom was lost to England, when the famous Armada was shattered. In the seventeenth century, under Philip III, Philip IV, and Charles II, insurrection, religious persecution, bankruptcy, and civil war weakened the kingdom. The Netherlands (which see) were lost. At the close of the War of the Spanish Succession (see SUCCESSION WARS), Spain had to relinquish Naples, Parma, Sardinia, and Milan to Austria, Sicily to Savoy, and Gibraltar and Minorca to England.

Relations with England and France. A short period of prosperity followed, but at the

close of the eighteenth century, Spain entered the war against the French Republic, losing Santo Domingo to France. An alliance was then made with France against England,

incapable and weak king, caused a military revolt.

In 1823 the Duke of Angoulême entered Spain with French troops, and succeeded in restoring order.

Ferdinand died in 1833, and at his request his daughter Isabella took the throne, with her mother, Maria Christina, as regent. In 1868 Queen Isabella was forced to abdicate, and a provisional government was established. In 1870 the Assembly voted to make Spain again a monarchy. An Italian prince, Amadeo of Savoy, was elected, ruled two years, and resigned in 1873. After an interval of republican government, Don Alfonso, the son of former Queen Isabella, was proclaimed the king of a new constitution monarchy.

Alfonso XIII was born a king in 1886. His mother, Maria Christina, acted as regent until he attained his majority in 1903. The principal event of the regency was the Spanish-American War in 1898, which resulted in the loss of Cuba, Puerto Rico, and the Philippines. Spain remained neutral during the World War.

In 1921 the Spanish army suffered a catastrophic defeat by the Riffian tribes of Spanish Morocco.

On 13th September, 1923, General Primo de Rivera engineered a *coup d'état* and took control of the government as dictator. His successor, General Berenguer, announced

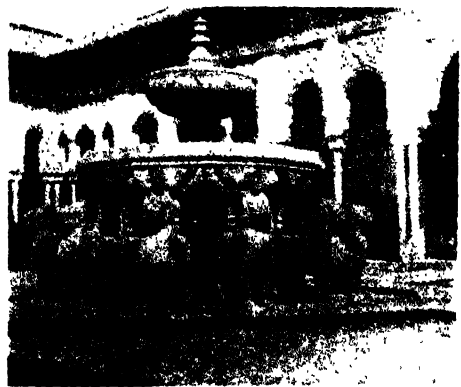


A COPPER MINE IN SPAIN

but the British victory at Trafalgar, October, 1805, permanently destroyed the Spanish naval power. Napoleon later conferred the Spanish throne upon his brother Joseph, and war with France followed. Napoleon victoriously entered Madrid, 4th December, 1808, but French occupation of Spain met with more persistent resistance than Napoleon calculated.

It was the support of Great Britain which enabled Spain to throw off Napoleon's rule. The Peninsular War, which occupied Spain, Portugal, and Great Britain against Napoleon from 1807 to 1814 had up to 1810 made more progress in Portugal than in Spain. Napoleon had left a large army under Masséna in Spain, hoping to keep the British back. However, Wellington's consistent victories, aided by the Spanish troops, were responsible for French defeat in Spain, which was complete by the end of 1813.

Vicissitudes of the Monarchy. Ferdinand VII was restored in March, 1814. During the struggles to save Spain, its colonies in the New World were revolting. Uruguay, Paraguay, Chile, Venezuela, and New Granada one by one threw off Spanish control. These losses, together with the despotism of the



COURT OF LIONS IN THE ALHAMBRA, GRANADA

Photo. George Long

the restoration of the Constitution in February, 1931.

The Republic. The elections resulted in a repudiation of the monarchy. Aznar

resigned, and the republicans demanded that the King abdicate. Alfonso refused to abdicate, but he and the royal family hurriedly left the country. Alcala Zamora immediately proclaimed a Republic, and assumed control as provisional President.

On 28th June, elections for the constitutional convention were held, the Socialist party won a decisive victory, and Zamora was elected President.

To safeguard its interests, the power of its principal opponents—Church, Royalists and Militarists—had to be curbed. Jesuits were expelled and other religious orders were either suppressed or brought under closer State surveillance. A royalist uprising led by General Sanjurjo was suppressed, but the Communist riots and the anti-religious persecution which followed upon the savage repression of this conservative revolt lost the left-wing parties the support of the country electors.

Reaction and Civil War. In 1932 the Catalans were granted home-rule, and the first Catalan Cortes since 1705 then met. Colonel Francisco Macia was chosen President.

In 1933, after new elections, the left wing parties lost power, the strongest party being the Catholic, led by Gil Robles. The moderate government now in power showed no more wisdom than its predecessor, and repressed all disorders by force of arms and imprisoned some 30,000. Moreover, hampered by the fact that it depended on the support of reactionary elements, it contented itself with repealing the laws which had been directed against the grandees and the Church, but did not initiate any new legislation for the benefit of the workers, either in industry or on the land.

In 1936 the left-wing parties came into power. At first there was little disorder, but as the extremists perceived that the government was not really Socialist, but merely represented a type of anti-clerical liberal common in France in the nineteenth century, it began to press for more advanced legislation. Zamora, as a retarding element, was forced to resign, and the organized Communist and Syndicalist clubs were used as a threat that violent action would be taken if their claims were not granted peacefully. The government gave in, but the conservative elements had had time to organize themselves in the years 1933-6, and there were many clashes between Fascists and Communists. Tension grew, and in July a military revolt, beginning in Morocco, spread quickly to Spain. It was the signal for the Communists, Anarchists, and Syndicalists to organize riots, during which fearful atrocities were committed. The military forces took up the challenge, and re-

prisals and counter-reprisals of the utmost barbarity distinguished this civil war. On the one side was the government, including Radicals, Socialists, Catalans, Basque Nationalists, Communists, Anarchists, and Syndicalists, assisted by half the navy and air force and a part of the army. On the other was the larger part of the army, including the Moorish troops and the remainder of the services; monarchists, including Carlists and Alphonsoans, and the large majority of the practising Catholics, except in the maritime Basque provinces, where the Basques supported the government in order to gain autonomy. The clash of foreign troops in the long battle for Madrid gave the war an international significance.

SPANIEL, *span' yel*. There are now seven distinct varieties of the working spaniel recognized by the English Kennel Club—the clumber, cocker, English springer, Welsh springer, field, Sussex and Irish water. The spaniel is a very old gun dog; the exact date of his introduction to England is unknown, but it was probably earlier than 1570.

The Clumber Spaniel was a favourite of King Edward VII and of King George V. The general appearance is that of a long, low, heavy, very massive dog (average weight 60 lb.) with a thoughtful expression. The eyes, dark amber, are slightly sunk in the head, and frequently show the haw. The neck is very thick and powerful, the body long and heavy and close to the ground, on short, thick, strong legs. The coat, which is plain white in colour with slight lemon or orange markings, preferably on the head only, is long, abundant, soft and straight. Clumbers are easily broken to the gun. They are slow workers, but very sure.

The Cocker, with a weight of only 25-29 lb., is the smallest of the spaniels—a merry little fellow, favourite in the field, on the show bench, and in the home. The eyes, very wide-awake, bright and intelligent, do not belie the nature. He has long silky hair, quite free from curl, and comes in a variety of colours.

The English Springer, whose popularity as a working dog has greatly increased during the last few years, has an average height of 19 in. at the shoulder and weight of 40 lb. The coat, flat or slightly wavy but never curly, may be practically any colour or combination of colours, but the most usual are liver-and-white and black-and-white. He is very fast and strong.

The Welsh Springer is smaller than the English, about 33-40 lb. The colour of the straight, flat, thick, silky coat is always red-and-white.

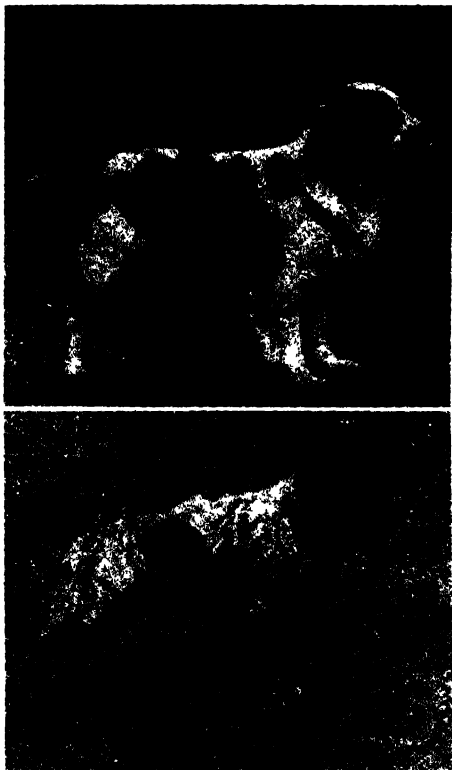
The Field Spaniel, which is lower on leg and longer in body than the English springer,

stands about 17 in. at the shoulder, and weighs about 45 lb. The general appearance is that of a well-balanced, noble, upstanding sporting dog, built for activity and endurance, grave in expression.

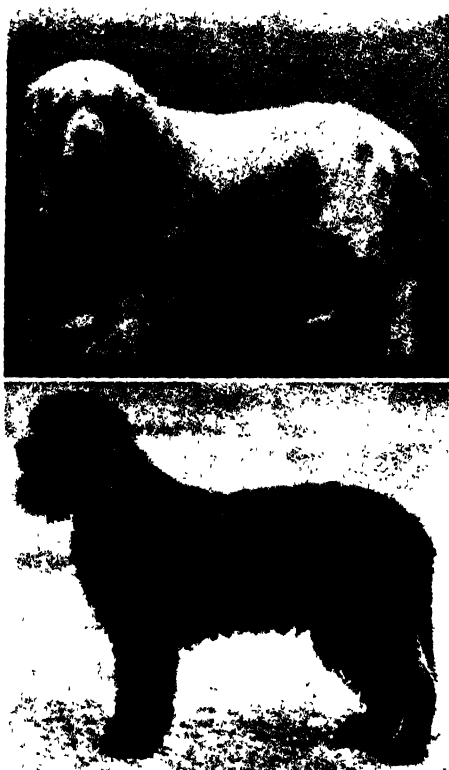
The Irish Water Spaniel. It is claimed by many authorities that the Irish water spaniel was the first of all spaniels, and that it is

is perfectly smooth, but the dog wears a "top knot" (objectionable in any other spaniel), consisting of long, loose curls growing down into a well-defined peak between the eyes.

The Sussex Spaniel is comparatively rare. The correct colour is a light liver tinged with gold, with no white markings whatso-



Top: Welsh Springer Spaniel. Bottom: Cocker Spaniel
Photos: Fall



Top: Clumber Spaniel. Bottom: Water Spaniel
Photos: Fall

certain that a breed of water dog existed in Ireland at the beginning of the Christian era.

The present-day specimen stands about 22 in. at the shoulder, much higher than any other variety. Unlike the other spaniels, the tail, or stern, is short and smooth (undocked), strong and thick at the root, where it is covered for 3 or 4 in. with short curls, and gradually tapers to end in a fine point; it is carried nearly level with the back in a straight line. The coat, composed of dense, tight, crisp ringlets entirely free from wooliness, should be of a very rich puce-liver, without markings of any kind, and no white on chest. The gait, too, is entirely different from any other variety of spaniel. The face

ever. The head carries a deal of loose skin which produces an expression very like that of the bloodhound, and gives an appearance of heaviness, but not of dullness. He is an excellent retriever from land or water. This spaniel, unlike any of the others, gives tongue when hunting. The eyes are deep amber to hazel in colour, fairly large, soft and languishing; the body coat abundant, flat without any tendency to curl, moderately well feathered on legs and stern. The weight is about 40-50 lb. and the height 15-16 in. at the shoulder. See also KING CHARLES SPANIEL.

SPANISH-AMERICAN WAR. A contest which grew out of the severity and injustice

of Spanish colonial administration in Cuba, which culminated in 1895 in an insurrection of formidable proportions.

Extreme measures were adopted by Weyler, the Spanish governor. Reports of atrocities committed by Spanish soldiers had been frequent, and had inflamed the feelings of people in the United States. President McKinley had affirmed the possibility of intervention, and the American attitude was naturally resented by Spain, and the Spanish government declared war on 24th April.

On 22nd April, the American North Atlantic naval squadron, under Commodore Sampson, began a blockade of Havana and the north coast. Dewey's Asiatic squadron at Manila Bay, on 1st May, destroyed the Spanish fleet, seized Cavite, and Manila fell on 13th August.

Meanwhile a Spanish squadron under Admiral Cervera, after a brief running fight, was destroyed. A land force invested Santiago. The city continued to offer resistance until 17th July. With its fall, Spain sued for peace, and on 10th December the Treaty of Paris was signed. Spain evacuated Cuba and relinquished Puerto Rico, the Philippines, and Guam to the United States, in return for an indemnity of £20,000,000. It was expressly understood that the American interest in Cuba was to be a simple trusteeship, and that a republic was to be established on the island.

SPANISH SUCCESSION, WAR OF THE. See SUCCESSION WARS.

SPAR. A popular term to denote crystallized minerals such as calc-spar or calcite, CaCO_3 ; heavy spar or bar-ytes, BaSO_4 ; fluor-spar, CaF_2 , etc.

SPARROW.

Small brownish-coloured birds. There are three common species of sparrow in Britain, the house-sparrow, tree-sparrow and hedge-sparrow. The first two are closely related and belong to the

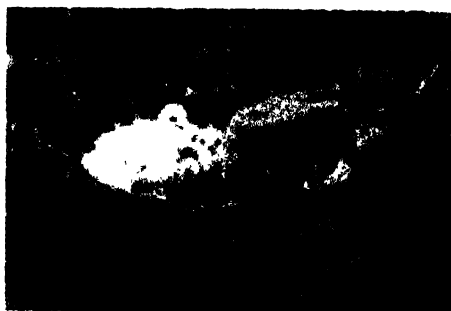
different family, in which the bill is slender and more like that of a pipit than a finch.

The house-sparrow is a very common resident in Britain, and is generally found about houses where the nest is built. This sparrow is found in Europe, Asia and Africa. It has been introduced into America and Australia, where it has become a pest.

The tree-sparrow is much less well known on account of its shyer nature, though it is a common enough bird in Britain. It is smaller than the house-sparrow; the top of the head is brown instead of black and there is a black patch on the side of the head. This sparrow is found throughout Europe and Asia. The hedge-sparrow is less common though a widely distributed resident bird in Britain. As its name signifies, it is more a bird of hedgerows than woodlands.

Scientific Names. The house-sparrow, *Passer domesticus*; tree-sparrow, *P. montanus*; hedge-sparrow, *Prunella modularis*.

SPARROW-HAWK. A bird of prey which breeds commonly in wooded districts through-



SPARROW-HAWK AND YOUNG
Photo: Cherry Kearton

out Europe and in Asia, and migrates as far south as North Africa. It is probably one of the commonest birds of prey in Britain and is very generally distributed.

As is usual in birds of prey, the female is much larger than the male. The underparts of the female are whitish, barred with brown. In the male the back is a slaty blue.

The food of the sparrow-hawk is small birds, mammals, etc., and even poultry.

Scientific Name. *Accipiter nisus*.

SPARTA. Also called LACEDAEMON. One of the principal cities of ancient Greece, the capital of Laconia, in the south of the Peloponnese. Sparta was built on a low range of hills sloping down to the river Eurotas. Hemmed in by high mountains of the Taygetus and Parnon ranges, its defensive position was very strong, so much so that until the Macedonian period it was never enclosed by walls.



COCK-SPARROW
Photo: John Kearton

finch family, characterized by a short thick bill adapted mainly for seed-eating. The hedge-sparrow is very similar in size and general appearance but belongs to quite a

History. In Homeric times, Sparta was already an important Achæan city, though less powerful than Mycenæ. It was ruled over by Menelaus, brother of Agamemnon, and husband of Helen of Troy. Two generations later, according to the chroniclers, occurred the invasion of the Dorians, a war-like people from the north, who conquered



LYCURGUS PRONOUNCING ON A POINT OF LAW
Photo: Newton



Photo: Newton

the Peloponnese, making Argos and Sparta their chief cities. The Dorians of Sparta soon showed themselves to be the most martial of their race, spreading their conquests over Messenia and southern Arcadia and Argolis, so that by the time of the Persian Wars at the beginning of the fifth century B.C. Sparta was the acknowledged head of Greece. The rise of Athens in the fifth century as a rival to Sparta made a trial of strength between the two states inevitable; after the long struggle of the Peloponnesian War (432-404 B.C.) the victory rested finally with Sparta, which for the next thirty years enjoyed an almost unchallenged supremacy. The Spartans, however, had no aptitude for government; intolerant, arrogant, and corrupt, they had aroused almost universal hostility when in 371 B.C. their

defeat by the Thebans at Leuctra put an end to their domination. From this time forward the history of Sparta is mainly one of decline. The victorious Thebans liberated Messenia from the Spartan yoke and founded the independent city of Megalopolis in southern Arcadia; and Philip of Macedon further curtailed the Spartan territory. In the third century B.C. Sparta had a brief renewal of vigour under King Cleomenes III; but defeat in war and revolution at home put an end to this phase. Nevertheless, Sparta was one of the last of the Greek States to make an effective resistance to the overwhelming power of Rome; and even under the Roman empire the Spartans enjoyed some measure of independence.

Constitution and Customs. Sparta is an unique example in antiquity of what is nowadays called a "totalitarian" State. The whole life of the citizen was devoted to the pursuit of military efficiency, and from early childhood was controlled and regimented by the State in a discipline the severity of which has made the word "Spartan" proverbial. A rigid caste-system divided the people into three classes, nobles (*Spartiates*), countryfolk and *helots*. The last-named class were serfs, and until the Battle of Leuctra included the conquered Messenians. The noble cast of *Spartiates* was itself divided into two classes, first the "peers," being those who had passed successfully through all the stages of the severe military training, and secondly the "inferiors," who had failed to satisfy the test. Only the Spartan peers had full civil and political rights and were allowed to join the regimental dining messes, membership of which was the highest privilege among the Spartans. The political constitution of Sparta was curiously complex and reflected the jealousy of the ruling families for each other. At the head of the State were two hereditary kings, one from each of two noble families. The kings were the commanders of the army and also had certain priestly duties. Political power they shared with five magistrates called *ephors*, who were elected annually. There was also a Senate (*gerousia*) of thirty life-members (including the two kings) and a general Assembly (*apella*). Membership of the Senate, and perhaps also of the Assembly, seems to have been confined to *Spartiates*. The Spartans ascribed the origin of all these institutions to a legendary lawgiver called Lycurgus, and in substance they remained unchanged until the time of the autocratic king Cleomenes III, who abolished the office of *ephor*. See GREECE (Ancient History).

SPARTACUS. Roman gladiator and the leader of a formidable slave rising. He was

born in Thrace, but was made prisoner by the Romans, sold as a slave, and taken for training to a gladiatorial school in Capua. With seventy comrades he escaped and established himself on Mount Vesuvius. Slaves seeking freedom flocked to him in large numbers, and he won several notable victories against the Senatorial army.

In a short time he gained possession of almost all of Southern Italy. Two consuls were sent against him, but he defeated them both and led his followers toward the Alps, meaning to lead them out of Italy. The slaves themselves, however, called on Spartacus to lead them against Rome. In 71 B.C. a pitched battle between the rebels and an army under Marcus Licinius Crassus resulted in the annihilation of Spartacus's forces. He himself showed incredible valour before he met his death.

SPASM. An abnormal involuntary contraction of one or more muscles. The more violent and extensive varieties are known as *convulsions*, the less violent as *tremors*.

Perhaps the best-known example is the condition known as *infantile convulsions*, due to teething, or to some more serious disease affecting the brain in infants. This may be an extremely dangerous condition, and no time should be lost in putting the child into a warm bath, or in administering a few whiffs of chloroform as an emergency measure. The most violent type of convulsions occur in certain diseases in which irritation of the brain is a prominent feature, such as *uraemia*, *puerperal eclampsia*, and *strychnine poisoning*. In these cases the patient is usually unconscious, throws himself about uncontrollably and wildly, and often causes injury to himself and others. The jerky movements which occur in St. Vitus' Dance (which see) exemplify a milder form of spasm; and indeed all stages are experienced down to those tremors which are seen in such diseases as *paralysis agitans*, *alcoholism*, or in shivering due to cold.

All the above examples are of interrupted, or *clonic* spasms, but there is another kind, continuous or *tonic* spasms; in these the contraction or shortening of the muscles concerned is continuous, so that the part affected is maintained in an abnormal position for the duration of the attack. We see such tonic spasms in cases of lockjaw or *tetanus*.

SPAVIN, *spav' in*. A disease affecting the hock of horses. It occurs in two forms, *bone spavin* and *bog spavin*. Bone spavin consists of a bony enlargement on the inside of the hock, at the head of the shank bones, or between the small bones of the shank. At first the spavin grows very slowly, and it may

not be noticed until the horse becomes lame. No effective treatment has been discovered.

Bog spavin is a soft swelling around the joint caused by the accumulation of synovial fluid (joint oil), and is usually caused by straining the joint. The treatment consists in hot applications, blistering, etc.

SPAWN. The eggs of fishes, molluscs, frogs, and reptiles, especially when found in masses. Usually, they are produced in great numbers. The production of countless millions of eggs by water-inhabiting animals is necessary to keep the different species from extinction. The collected masses of eggs of sturgeon are used in making *caviare*.

SPEAKER. The title of the presiding officer in the lower house of various national, state, and provincial legislatures.

The term had its origin in a custom of past centuries in Europe, when legislative bodies were addressed by the head of the government, and the presiding officer was expected to respond.

In the British Parliament, the House of Commons is presided over by the Speaker and the House of Lords by the Lord Chancellor. The Speaker of the House of Commons is always a member of that body, and is elected by the members, subject to the approval of the sovereign. It was at one time a Crown appointment, but the right was surrendered in 1679.

In the United States House of Representatives the Speaker is a political force; he is the head of the political party in majority and is elected by them. If he wishes to speak on any matter he leaves his chair and appoints a deputy.

The British Speaker seldom speaks in his capacity as a member of the body, and votes only in the case of a tie. Not since 1761 has it been a political appointment, although for some time afterwards the Speaker was not free from party politics and occasionally entered into debates; but since 1835 it has become a custom of Parliament that the Speaker shall divest himself of political aspirations and remain an impartial chairman of debates. The symbol of his authority is the mace, which is carried before him by the sergeant-at-arms whenever he enters or leaves the House. His salary is £5000 a year, and he is provided with a house within the precincts of Parliament.

SPEARMINT. A species of mint found in temperate regions in most parts of the world, which yields an oil used in the preparation of perfumes, medicine, chewing gum, soup, and sauce. The spearmint plant has smooth, erect, stems that grow 1 or 2 ft. in height and, at the top, bear whorls of pale-purple or white flowers.

Scientific Name. Spearmint belongs to the family *Menthaceae* (or *Labiales*). Its botanical name is *Mentha spicata*.

SPECIE, spe' she. This denotes coined money of any description, as distinguished from paper money and bullion. It covers coins of gold, silver, and other metal. The word is also used in several money market terms. *Specie payments* are those made in coin; *specie point* is that price above the mint par of exchange at which it is cheaper to transmit bullion than to buy bills of exchange in order to make a payment abroad. In normal times, when specie point is reached, gold bars are imported or exported, if there is a free market for gold and the countries concerned are on the gold standard. See FOREIGN EXCHANGE.

SPECIES, spe' sheez. In plant and animal life, a term signifying a certain degree of resemblance or relationship. As a general, though not invariable rule, the individuals of one species cannot breed with those of another. If they can then the resultant hybrid is in *intermediate*.

Other degrees of relationship, increasing in generality, are genus, family, order, etc.

SPECIFIC, spes' if' ik, GRAVITY. See GRAVITY, SPECIFIC.

SPECIFIC PERFORMANCE, DECREE OF. See CONTRACT.

SPECTACLES. An instrument or device for aiding and correcting defective sight, consisting of a pair of lenses, mounted in a frame to hold them in position before the eyes. The first device of this kind is said to have been invented by Roger Bacon, in the thirteenth century, but Italian antiquarians credit a Florentine monk with this achievement (1285). It was not until the eighteenth century that the grinding of lenses was first based upon the principles of the refraction of light. See LENS; EYE.

The lenses are made of clear or rock-crystal glass, and are ground to suit the defect of the eye. In cases of nearsightedness a concave glass is used; by this means, the rays of light are diverged and a clear image is formed on the retina. For longsightedness, the convex lens is used, converging the light rays. The thicker the lens, the greater is its magnifying power. Astigmatism, which is a structural defect of the eye, is remedied by cylindrical lenses which bring the rays of light to a common focus on the retina. The lenses are adjusted so as to make the distance of distinct vision about 12 in. from the eye.

Coloured glass is used in spectacles to protect the eyes from the glare of the sun.

SPECTROSCOPE, spek' tro sköp. An instrument for studying the spectra of bodies to determine their composition. The simplest form of spectroscope is a triangular glass

prism. For the purpose of analysis, it is necessary that each colour be sharply defined, and this definition is secured by the use of a telescope and other tubes, chief of which is the *collimator*, by which parallel rays are thrown on the prism.

The compound spectroscope used in obtaining spectra of the heavenly bodies consists of a series of prisms arranged in the arc of a circle, so that the spectrum is magnified by each before it is viewed by the observer. These spectroscopes are so constructed that they can be attached to the eyepiece of a large telescope. The dark lines appearing in the spectra of glowing bodies move towards one or the other end of the spectrum, according as the body under investigation is approaching the observer or receding from him. Upon this principle many important facts relating to the distances and velocities of stars have been discovered. See LIGHT; SPECTRUM ANALYSIS.

SPECTRUM. The image formed when the light rays of a body are dispersed after passing through a prism. See COLOUR; DIFFRACTION; LIGHT; SPECTROSCOPE.

SPECTRUM ANALYSIS. The investigation into the chemical composition of a substance by analysis of its spectrum. This is based on the fact that any glowing substance, such as molten iron or burning hydrogen, will produce a spectrum. Moreover, each substance, if in the gaseous state, forms a spectrum different from that of any other substance.

A spectrum that shows an unbroken array of colours from red to violet is a *continuous* spectrum, like that formed by sunlight. The spectrum formed from a single substance, like hydrogen, for instance, or that from a number of gases, is not continuous, but shows bands or lines of colour separated by dark spaces, and it is known as a *bright-line spectrum*. Experiment has shown that, when the light of a glowing substance is passed through the vapour of another substance, certain parts of the light are absorbed by the vapour, so that the dark lines appear in the spectrum. A spectrum formed in this way is called an *absorption spectrum*. To illustrate, the interior of the sun is a glowing mass, but when viewed through the spectroscope the solar spectrum contains a number of dark lines which are caused by gases that surround the heated interior of the sun, and absorb the colours that they produce in the spectrum.

Fraunhofer Lines. The different colours always appear at the same places in the spectrum of a substance. Consequently, when a dark line appears in place of the colour that a given substance, e.g. sodium, would produce it proves that the light from

the substance under observation is passing through the vapour of sodium. These dark lines were discovered by Fraunhofer, a Bavarian optician, and in honour of their discoverer were named *Fraunhofer lines*. The German physicist Kirchhoff concluded that these lines were caused by the presence in the sun's atmosphere of those substances which themselves produce bright lines in the same position on the spectrum.

In addition to its use in astronomy, spectrum analysis is employed in testing minerals for the discovery of new metals. It is also employed in testing the purity of substances. See CHEMISTRY; COLOUR; LIGHT; SPECTROSCOPE.

SPEED-BOAT. See MOTOR-BOAT

SPEEDWELL. A number of plants bear this name, and the common speedwell may be taken as a type. The flowers are tiny, pale blue with four petals, and borne on stems four to twelve inches long which grow from the leaf axils. The flowers are tightly clustered up the extremity of the stem. The leaves are egg-shaped, have serrated edges and, like the stem, are hairy. The plant has a creeping habit and is perennial, flowering in waste ground throughout the summer.

Scientific Names. The speedwell is in the genus *Veronica* of the figwort family, *Scrophulariaceae*. The common speedwell is *V. officinalis*.

SPELTER. See ZINC.

SPENCER, HERBERT (1820-1903). An English philosopher and man of letters whose *Synthetic Philosophy* provoked more discussion than any other publication of the period. He was born in Derby and from 1837 to 1846 was in the employ of the London and Birmingham Railway, subsequently, until 1853, he served as assistant editor of the *Economist*.



HERBERT SPENCER
Photo: C. & L.

While working on his *Psychology*, which appeared in 1855, Spencer undermined his health.

Spencer's philosophy is chiefly occupied with defining the fields of the knowable and the unknowable. He made neither clear nor definite his expressions regarding the latter, to which belong the Absolute, the Infinite, Space, Matter, Time, Force, and Motion. What he aimed to establish was that the very fact that we cannot solve ultimate metaphysical questions compels us to admit the existence of

some supreme power behind the unknowable phenomena.

His great contribution to science lay on the positive side, where he dealt with the knowable, and aimed to reduce its laws to unity. The idea of evolution he applied, first, to all forms of organic life, and then to social and political institutions. He declared knowledge is gained by twofold experience, that of the individual and that of the race; inherited intellectual tendencies, therefore, are an important determining factor. The prevailing law which governs the phenomena of nature is the persistence of force: there is continuous order in all things, and a prevalent suggestion of a common origin. Hence, despite his protests, he became a materialist. He declared all forms of phenomena to be the result of a passing from the simple to the complex. He explained the universe as a gradual development, instead of accepting the doctrine of catastrophic or accidental development.

Evolution is his ultimate law of nature, counteracted by one other force, that of dissolution, whether or not there is progress depends on the relative strength of the former.

Spencer stands as the great representative of the scientific movement of the last part of the nineteenth century. Many of his theories are discredited, but his attempt to satisfy the need of a comprehensive survey of the world as a whole, in terms of facts rather than abstractions, won for him high rank among the great thinkers of all ages.

To Spencer's *Synthetic Philosophy* belong the following volumes: *First Principles*, *The Principles of Biology*, *The Principles of Psychology*, *The Principles of Sociology*, and *The Principles of Ethics*. His other works include *Essays: Scientific, Political, and Speculative*, *Social Statics*; *The Study of Sociology*, *Education*, *Intellectual, Moral, Physical*, *Various Fragments*, *The Inadequacy of Natural Selection*, *Descriptive Sociology*, and his *Autobiography*, published in 1904.

SPENSER, EDMUND (about 1552-1599). English poet, born at East Smithfield, London. He was sent to the Merchant Taylors' School, then became a student at Pembroke Hall, Cambridge, and in 1576 received from the university the degree of M.A. Two years later, he was taken into the household of the Earl of Leicester, and in 1579 published *The Shepheardes Calender*. This poem, a series of twelve pastoral eclogues, one for each month of the year, was dedicated to Sir Philip Sidney, who introduced the young poet to the court. The next year, Spenser was made under-secretary to the lord-lieutenant of Ireland, and took part

in restoring peace in that country at the time of Desmond's rebellion.

After the year 1586 he lived in Kilcolman Castle in Cork, as possessor of a large estate given him by the government. Here he continued the writing of the *Faerie Queene*, begun several years before, and upon the advice of Sir Walter Raleigh, who visited him in 1589, submitted the manuscript at court. The only encouragement given him was a meagre pension, and his *Colin Clouts Come Home Again* shows his chagrin at his defeat. However, he published the first three books of his allegory in 1590. Some-

what later appeared a volume of short poems entitled *Complaints*.

After his return to Ireland, Spenser married Elizabeth Boyle. The courtship was described in the *Amoretti*, a series of sonnets, and the marriage was made memorable by the *Epythalamion*, the finest of English wedding songs. The year 1596 is notable as

that in which appeared three more books of the *Faerie Queene*; *Four Hymnes*, celebrating love, beauty, heavenly love, and heavenly beauty; and the fine *Prothalamion*. At this time, too, was written his *View of the Present State of Ireland*, not published for many years.

The *Faerie Queene*, though not completed, ranks among the greatest narrative poems in the literature of the world. The form of stanza Spenser used has since been given his name. See following article.

SPENSERIAN STANZA. A verse form originated by Spenser for his *Faerie Queene*. It is a nine-line stanza, the first eight lines containing ten syllables each, the last twelve syllables, while the rhyme scheme is *a b a b b c b c c*.

SPHAGNUM, *sfa'g'num* The bog moss, a plant found growing in masses in swamp-land, and whose annual growth and decay forms spongy beds of peat. The straight stems, a few inches long, bear male and female organs on separate buds. Owing to its moisture-retaining qualities, sphagnum is much used by gardeners for packing, etc. It is the only representative of the family *Sphagnaceae*.

SPHENOID, *sfe'noid*, **BONE.** One of the eight bones in the head (which see).

SPHERE, *sfeer*. A curved surface, all points of which are equally distant from a

point within, called the *centre*. The distance from the centre to the surface is the *radius*. The distance from any point on the surface through the centre to the opposite point on the surface is the *diameter*.

The surfaces of spheres are to each other as the squares of their radii. The volumes of spheres are to each other as the cubes of their radii or the cubes of their diameters. The volume of a sphere is, roughly, one-half the volume of a cube whose edge is equal to the diameter of the sphere.

SPHINX, *sfinks*. In Greek mythology, the sphinx was usually represented as a lion, having the head of a woman, the tail of a serpent, and the wings of a bird. This creature lived in a cliff just outside the city of Thebes, and kept guard over the road to the city. To every passer-by she put this riddle: What animal is it that walks on four legs in the morning, two at noon, and three in the evening? Any person who failed to answer correctly was immediately devoured. Legend relates that Oedipus was the first man to solve the riddle, declaring the animal to be man, who walked on his hands and feet when young, erect on his two feet in middle life, and with the aid of a staff in old age. Whereupon the sphinx in a frenzy of rage hurled herself from the rocks and was killed.

The sphinx of Egyptian legend had the head of a man and the body, legs, feet, and tail of a lion. It had no wings until a later period, when the Greek influence was felt. Originally, the sphinx was supposed to represent the god Horus, guardian of temples and tombs; and when sculptured the face was probably made to resemble the Pharaoh who ruled at that time.

The Great Sphinx stands close to the Great Pyramid at Gizeh; it is carved out of solid rock, except the paws, which are built of masonry. The figure is 172 ft. long and 66 ft. high, its head is 30 ft. in length, and the width of its face is 14 ft. The age of the Sphinx is unknown, but it is considered well established that it was in existence at the time of Cheops, and was repaired by him about 2900 B.C.

SPICE. The general name for a group of pungent and aromatic vegetable products, used chiefly to season foods. The various spices, such as pepper, nutmeg, cloves, ginger, allspice, mace, mustard, cinnamon, and capsicum, are derived from different parts of plants; for example, cloves are procured from the bud, cinnamon from the bark, pepper and nutmeg from the fruit, ginger from the root, and mustard from the seed. The food value of spices arises from the stimulating effect they have on the digestive organs. Their nutritive value, however, is negligible.



EDMUND SPENSER
Photo - Brown Bros.



THE GREAT SPHINX

The feet were uncovered in 1926. Before the excavation the sand covered the figure to the dark line about midway up.

Photo: Wide World

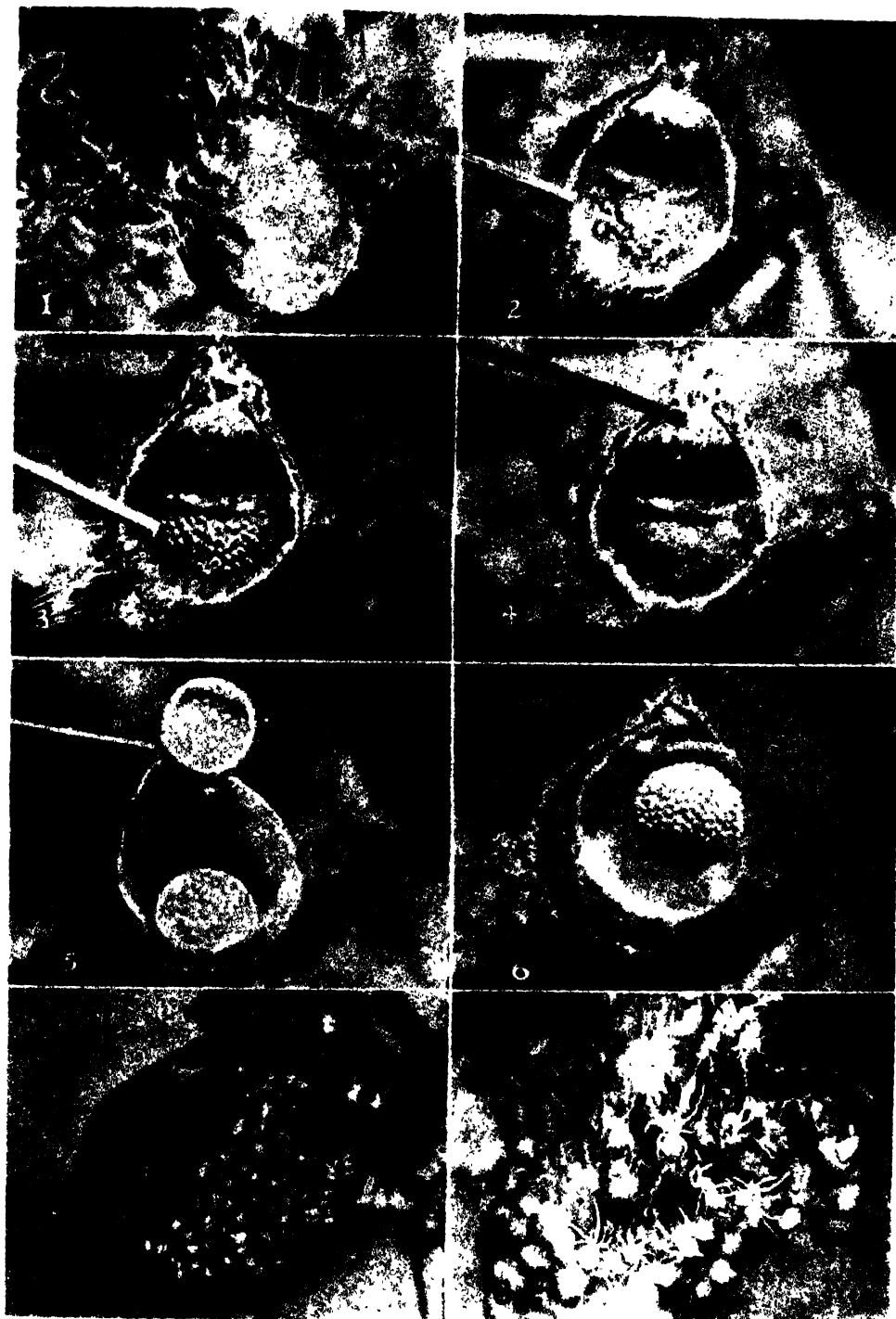
SPIDER. Spiders are not insects in the true sense of the word, but belong to a subdivision of that large section of the animal kingdom, the *Arthropoda*, which includes insects. Spiders, scorpions, ticks and mites

are related and together form a class. This class is characterized by the fact that there is no narrow "neck" between the head and body. Both are fused together to form what is called a cephalothorax. But there is



GARDEN SPIDER

Left: An insect caught in the web. Right: The spider attacking his prey.



DEVELOPMENT OF THE GARDEN SPIDER

1. The egg sac in early September. 2. The interior of the sac. 3. The eggs. 4. How the stopper closes the mouth of the sac. 5. The silky underside of the stopper. 6. Eggs with silk removed. 7 and 8. Baby spiders; they remain in the sac until Spring.

generally a clear division between cephalothorax and abdomen. Another characteristic is that there are eight legs (4 pairs)



ENTRANCE TO TRAPDOOR SPIDER'S NEST

Photo: Cherry Kearton

instead of the six found in insects. The eyes are simple, unlike the large compound eyes of most insects. Finally, there are no great changes in appearance during development, as, for example, between caterpillar and butterfly, but the young are hatched exact miniatures of the adult.

Spiders are very adaptive in their habits, and are found almost everywhere; some even make their home in the water. Most spin a web in which to catch the insects which are their prey, and whose juices they feed on; others are more wandering in their habits and catch their food by other means. Many species are known, including some remarkable tropical forms, like the trapdoor spider, and other kinds which reach a large size. See also TARANTULA.

When the prey is caught it is killed by means of a poison which is exuded through perforated fangs in the mouth region.

The silky material of which spiders' webs are formed is produced in special silk glands situated in the abdomen. The liquid silk is exuded through modified appendages, called spinnerets, and hardens when it comes in contact with the air. As well as being used as an insect trap, the silk is used as a lining

for the nest. Gossamer is the parachute which some spiders secrete to carry them through the air. Thus many spiders, though they are wingless, can travel long distances.

SPIKENARD, *spik' nard* (i.e. "spiked nard"). A plant of the valerian family, native to India, and the perfume yielded by it. The perfume appears to be more adapted to eastern tastes than to those of Europeans. The root of the plant, which is shaped like an ear of corn, bears at the top a cluster of thick stems about 2 in. long, and it is this part that is principally collected for the extraction of perfume. The precious ointment of spikenard mentioned in the Bible (see Mark xiv. 3-5, John xii. 3-5) was probably an oil or fat scented with the perfume.

Scientific Name. Nard is *Nardostachys julamansi* in the family *Valerianaceae*.

SPILSBURY, SIR BERNARD HENRY (born 1879). Hon. pathologist to the Home Office and specialist in forensic medicine. He is consulted in all difficult investigations of crime when the examination of human organs may possibly provide clues, and his expert evidence has on many occasions been decisive in the determination of guilt or innocence. Among the most sensational trials in which Sir Bernard Spilsbury has been called in as a special witness are those of Dr. Crippen (1910), Smith (the "Three Ladies in the Bath" case, 1912), Patrick Mahon (the "Seaside Bungalow" case, 1924), Browne and Kennedy (for the murder of P.C. Gutteridge, 1927), Alfred Arthur



TRAPDOOR SPIDER ENTERING ITS NEST

Photo: Cherry Kearton

Rouse (who disposed of his victim by burning him in a motor-car, 1930), and Dr. Buck Ruxton (who dismembered the bodies of his wife and nursemaid, 1936).

Dr. Spilsbury is lecturer in toxicology and forensic medicine at the London School of Medicine, and among his published works are *Wounds and other Injuries in their Medico-Legal Aspect* and *Criminal Abortion*.

SPINACH, *spin' aj*. A popular garden vegetable cultivated for its nutritious leaves, which are cooked as greens and are also used in making soup. Though cooked spinach is nearly nine-tenths water and has only small proportions of protein, fat, and carbohydrates, it is rich in iron and contains vitamins. Spinach is also strongly laxative, for it has a large amount of cellulose, or roughage.

There are two general classes: *prickly spinach*, with arrow-headed leaves and a fruit pod covered with spines; and *smooth spinach*, with round leaves and smooth fruit.

Scientific Name. Spinach belongs to the family *Chenopodiaceae*. Its botanical name is *Spinacia oleracea*.

SPINAL CORD. The part of the central nervous system which is situated in the vertebral canal (see SKELETON). It is connected with the other part, the brain, at its upper end, where it passes through a large opening in the skull, the *foramen magnum*; and it extends down to the first lumbar vertebra, being about 17 in. long. Like the brain, it is composed of grey and white matter and is protected by three membranes continuous with those covering the brain. Between these membranes is a fluid called the *cerebro-spinal fluid*.

In the lower orders of vertebrate animals, the spinal cord comprises by far the more important part of the central nervous system, the brain being very small and, compared with that of man, insignificant. The functions of the cord are mainly concerned with reflex actions, that is, the automatic response of the body to stimuli quite independently of consciousness, volition and intelligence. For a fuller description see NERVOUS SYSTEM.

SPINET, *spin' et'*. A form of small harpsichord, more frequently known as the Virginal (which see).

SPINNING. An ancient household industry adapted to the needs of modern industry. It is a process of making threads by twisting vegetable or animal fibres, and was originally accomplished by means of a spindle and distaff. The spindle was a stick from nine to fifteen inches long, tapering at both ends, and having a notch at one end for catching the thread; the distaff was a staff upon which the fibres were bound in a loose coil. The spinner rotated the spindle by rolling it against the thigh with the right hand, while the fibres were gathered and arranged with the left. In the sixteenth century,

the progress of spinning was aided by the invention of a spinning-wheel.

The complete revolution in the art and practice of spinning was due to three notable inventions of the eighteenth century—the spinning-jenny (1767) of Hargreaves, the cotton-spinning machine (1769) of Arkwright, and the mule spinner (1779) of



GERMAN WOMAN AT HER SPINNING-WHEEL.
Photo—Keystone

Crompton, and all modern machinery is based on eighteenth-century models.

Cotton-spinning as carried on in a modern factory may be taken as a type. After the raw cotton has been cleaned and arranged into laps of uniform size, it is carried to the carding machines, equipped with huge rollers covered with wire teeth, where the tangled fibres are straightened out and made to lie in straight, even rows. Then the fibres are rolled over and over one another to form *slivers*, which look like loose ropes of soft cotton yarn. A sliver goes through the processes of *drawing*, *slubbing*, and *roving*, by which it is twisted and retwisted and made continually finer and more perfect. The concluding operations are carried out in the spinning machines, in which the thread is finally given the required twist, firmness, and strength. See COTTON.

Spinning-Wheel. This was the first mechanical arrangement for applying a rotary motion to a spindle for spinning cotton or flax into threads. The principle was the same as that of the spindle used by hand,

but when the spindle was mounted horizontally, and a band or small belt was passed from a groove in the spindle over a large wheel, turning the wheel by the foot gave the spindle a more uniform motion.

The material to be spun was carried on a distaff. The wheel was turned with the left hand or foot, the material being drawn out by the right hand. The degree of fineness depended on the rapidity with which the twisting thread was drawn out. For very fine thread two spinnings were necessary.

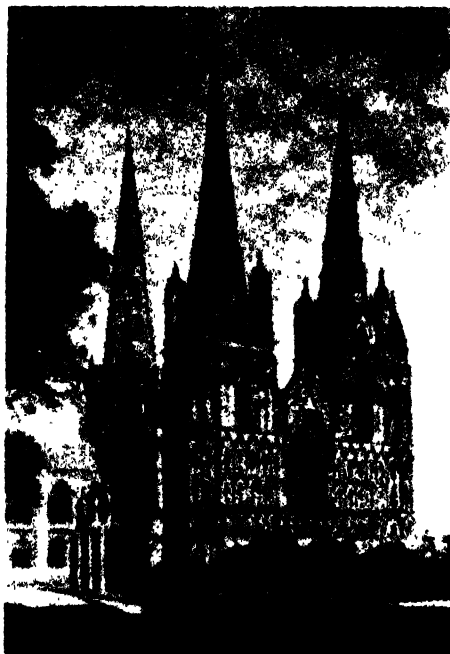
Spinning-Jenny. A device invented about 1767 by James Hargreaves, of Lancashire, by which sixteen or more threads could be spun simultaneously. The name *jenny* is derived from *gin*, which was the local term for *engine*. In the spinning-jenny, spindles were placed vertically and were rotated by a wheel worked by hand. The jenny was replaced by the *mule*, which contained most of the important features of the jenny, with added improvements.

SPINOZA, *spin o' za*, BARUCH {BENEDICT} (1632-1677). A Dutch-Jewish philosopher, born in Amsterdam. He received careful instruction in Jewish theology, but under the influence of the philosophy of Descartes and Giordano Bruno, he broke with the Jewish faith, and his heretical views brought about his excommunication in 1656. He lived in solitude at The Hague, depending for a living on the profits from lens-making, in which he was proficient, and declining both the chair of philosophy at the University of Heidelberg and the pension offered him by Louis XIV of France.

His philosophy developed into a complicated pantheism. It declared that God exists, and that His manifestations, or attributes, are two: extension (that is, the world of material things) and thought. It denied any causal relation between mind and matter, and so he had to apply a theory of parallelism to explain what was apparently interaction between the two. For every idea there is a physical object; for every material thing a corresponding particular idea. Though the physical and intellectual causal series never interact, both are dependent on God, the Substance and Creator. Man is not free: God alone is free. That is, man is a limited manifestation of God, and God alone is Cause, Effect, and Purpose. Man's attention must be riveted on the spiritual, for whenever particulars blind him and remain his ideal, harm and evil result.

SPIRAEA, *spir re' a*. Three plants of this genus are found in Britain, but not all are native. These are the willow-leaved spiraea, the meadowsweet, and the dropwort. The first of these, which appears to thrive more in the north-west parts, is a

shrubby plant which grows to a small bush. The leaves are oval and have serrated edges. The flowers, which come in late July, are borne in a tight spike along the end of the stem. They are pink, and have five petals and many long stamens. The meadowsweet is not a shrub; its stem is usually about 2 ft. high. The flowers, which are borne in a



TRIPLE SPIRES OF LICHFIELD CATHEDRAL.

Photo: Taylor

cluster, are cream-coloured. They are common wild flowers, and are especially notable for their sweet scent. The dropwort, in contradistinction to the meadowsweet which, as its name implies, loves lush meadow land, is often found on wayside banks. It is easily distinguished, since before the flowers open in their white beauty the buds are pink.

Scientific Names. The spiraea is a genus of the rose family, *Rosaceae*. The willow-leaved spiraea is *S. salicifolia*; the meadowsweet, *S. ulmaria*; the dropwort, *S. filipendula*.

SPIRE. In architecture, that part of a tower which rises from the upper portion in the form of a pyramid. In the earliest form, the spire was little more than a slightly raised, four-sided roof, but gradually these structures became taller, more slender, and usually octagonal in shape. The cathedral at Cologne has spires rising to over 500 ft. high, while the finest spire in England, that of Salisbury Cathedral, is 406 ft. in height.

The term "shingled spire" is applied to a spire whose base overlaps the tower on which it is raised.

SPIRILLUM, *spi ril' um*. See BACTERIA AND BACTERIOLOGY.

SPIRITUALISM. A movement, founded on the beliefs, first, that in the presence of certain peculiarly gifted people (called *mediums*) phenomena occur which cannot be accounted for on any principles recognized by the existing sciences, and secondly, that these phenomena are caused by the spirits of the dead, who are attempting by these means to convey messages and instruction to the living.

Types of Psychic Phenomena. Of all types of psychic phenomena undoubtedly the most impressive is the *materialization* of spirit-forms. Those at the seance see the figure of a man or a hand appear out of the surrounding darkness. These materialized forms often have a distinctive personality, which is maintained not merely throughout a single seance, but over numerous appearances at different seances. Another remarkable phenomenon is the *direct voice*, so called as opposed to *trance-speaking*. The latter is a voice which issues from the mouth of the medium when he is in trance, and which is ascribed to a spirit. The "direct voice" is a voice projected through a trumpet which is part of the regular equipment of seances. This form does not always necessitate the medium being in a trance. Often two or three voices are heard at the same time. Written as well as spoken messages play a large part in Spiritualism. The most common method of obtaining written messages is *slate-writing* (sometimes called *psychography*). A slate, with a crumb of slate-pencil on it, is held by the medium pressed against the under-side of a table. The sound of writing is heard, and when it stops the slate is removed and found to contain written matter. Another method is *automatic writing*, which is done by the medium himself in a state of trance. A mode of communication which is far commoner than either speaking or writing is *rapping*. Almost all the great mediums have had the faculty of producing this curious form of telegraphy. A conventional code or alphabet has been established, and to this the mysterious senders of the messages readily conform.

Spirit-photography is another most remarkable phenomenon, though it rather lends itself to fraud. Other types of phenomena must be mentioned briefly; such are *clairvoyance* and *clairaudience* (see CLAIRVOYANCE), *apports* (i.e. inanimate objects materialized in the course of a seance), levitation, the appearance of lights, the

playing of musical instruments without human agency, and the removal of objects from one part of a room to another. It is these last-mentioned types of psychic phenomena which are the principal bone of contention between the Spiritualists and the conjuring profession, who in many cases have claimed to "expose" these performances as fraudulent by showing that similar effects can be produced by means of ordinary conjuring.

History. The event which gave the real impulse from which Spiritualism has sprung occurred in March 1848, at Hydesville, New York State, in the house of a humble family of the name of Fox. The family were disturbed for some days by a mysterious rapping noise. One day one of the Fox children, a little girl, snapped her fingers several times and playfully commanded the unseen rapper to imitate her. She was instantly obeyed, and by an alphabet of raps connected messages were received. Both Kate and Margaret Fox, the two youngest children, and their elder sister Leah, became famous mediums, and the gift rapidly spread all over the world. In later life (1888) Margaret Fox declared that her performances were all trickery, but she never explained how the trick was done and a year later she retracted her statement. Meanwhile Daniel Douglas Home had made many converts to the new movement by his remarkable manifestations of the "direct voice," trance-speaking and levitation. Towards the end of the nineteenth century mediumship reached its zenith in the cases of the Eddy brothers of Vermont, U.S.A., and Eusapia Palladino, a poor and illiterate Neapolitan.

The physical aspect of these phenomena is explained by Spiritualists as being due to the action of a substance which, they say, emanates from the body of the medium and which they call *ectoplasm* (which see). The rest of their teaching is derived from the contents of the messages which they receive in the various ways described above.

See also PSYCHICAL RESEARCH.

SPITSBERGEN. An Arctic archipelago lying north of Scandinavia between lat. 74° N and 81° N. With Bear Island (70 sq miles), lying about half-way from Norway, it constitutes the Norwegian possession of *Qvalbard*. The total area is about 25,000 sq. miles. The land is rugged and mountainous on the west and a plateau of low elevation in the middle and east. The greatest heights are under 6000 ft. and most summits are not over 3000 ft. The country is much dissected by deep fault troughs, filled by arms of the sea, which give access to the interior and provide excellent harbours. The climate is Arctic, with low winter



PRINCE KARL FJORDLAND, SPITSBERGEN
Photo: Norddeutscher Lloyd

temperatures but an open summer of three months or more with many relatively warm days. Glaciers fill most of the valleys and flow down to the sea. Pack-ice surrounds the islands except on the west in winter, the west being kept open as a rule by the Atlantic drift. Vegetation is a scanty form of tundra which does not completely cover the land. There are no trees, and no agriculture is possible. Wild animals include reindeer, musk-ox, fox, seals and polar bears, and many birds. There has never been a native population. Coal occurs in great quantities and of good quality. In 1934 only two mines were working, and about 260,000 tons were exported to Norway. Gypsum also occurs.

SPITZ. See POMERANIAN.

SPLEEN. The largest gland of the body not having a discharging tube. It lies below the diaphragm, to the left and a little back from the stomach (see GLANDS). In adults the spleen is about 5 in. long and 3 or 4 in. wide, and it weighs about 7 oz.; it is soft and spongy, crumbles easily, and is a deep violet-red in colour. The organ is a mass of cellular tissue covered by a fold of serous membrane from the peritoneum, or membrane that lines the abdominal cavity, which passes over it from the diaphragm, holding it in place.

The function of the spleen is not definitely known. It may be completely removed from the body without any demonstrable ill effects. Before birth there is evidence that some of the red blood-cells are formed by the spleen. This function seems to cease after birth, and the organ seems to be concerned in some way with the destruction, rather than the formation, of red cells.

The spleen belongs to the lymphoid system of the body.

SPLENIC, *splen' ik*, **FEVER.** See ANTHRAX.

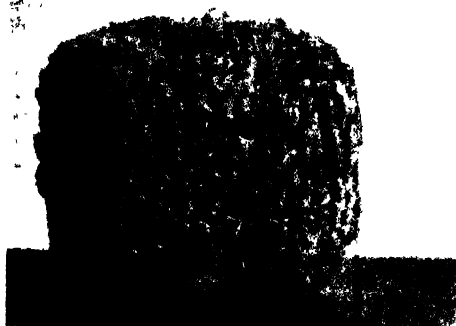
SPLICING. Joining two rope ends, or making a loop in a rope, etc., by interweaving the strands. In the short splice and cut splice, the strands are tucked beneath and over one another; in the long splice, one strand is unlaid at a time and replaced by a strand of the other rope.

SPLIT INFINITIVE. See INFINITIVE.

SPONDEE. See HEXAMETER.

SPONGE. The common name given to a group of sea animals forming the lowest branch of living things composed of many cells. Their scientific name is *Porifera* (which see).

Structure. The sponge is only one step higher than the simplest form of animal life, the single cell. Beginning with a tiny egg,



SPONGES FROM FLORIDA
Above: Sheepswool. Below: Velvet
Photos: Visual Education Service

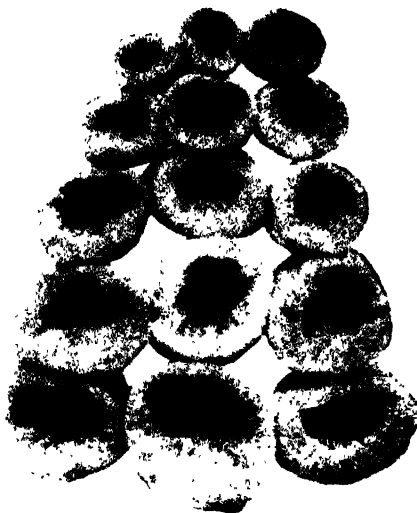
it develops into a soft mass of slimy flesh made up of many individual cells, all formed through the continued division of the original cell. Certain of the cells give rise to skeletal rods of many different shapes, composed of different material in different kinds of sponges. On the outer surface of the sponge



TYPES OF SPONGE

Elephant Ear Sponge or Levant Lapper (Spongia Officinalis). Regenerative tissue often remains on dead sponge, which is seen here with new growths that have arisen from it. 2. Crateromorpha Mayeri (variety Corrugata), Japan. 3. Euplectella Impervius Japan. 4. Siliceous sponge (Caulospongia Verticillata, North Western Australia. 5. Glass rope sponge (Hydomeira Sieboldii), Japan. 6. Spongia Equina (variety Cerebriformis). A variety of bath sponge from the Bahamas. 7. Callispongia Mexima, from the Bahamas. 8. Venus's Flower basket (Clupeella Aspergillum), Philippine Islands. 9. Rhabdocalyptus Victor from Japan.

body are countless pores. From this fact the sub-kingdom derives its special name of *Porifera*—meaning, literally, "bearing pores." Through these countless minute openings, the sea water streams in at all points, and is



GROUP OF MADROUKA FINE TURKEY
CUP SPONGES

carried into every part of the sponge's body by a network of canals, or tubes.

In the inner membrane, along the canals, are groups of cells provided with little lashes called *flagella*, which, by their constant waving to and fro, keep the water circulating, for the water brings oxygen, together with bits of plants and tiny living organisms. The sponge has no general stomach to digest this food; instead, each cell selects from the current whatever it needs. As the water flows out through the large outer openings, it carries away all waste matter and surplus food.

Sponges take many different shapes. Some sponges are thin and flat; some grow like low bushes with widespreading branches; some look like fans; others resemble cups, vases, or slender cylinders.

The Skeleton. On account of the jellylike substance of which the cells are composed, a skeleton is very necessary to support and protect the animal. In some species the skeleton looks like lime or white marble; in others it is flinty or glassy in appearance. The exquisite, lacy *Venus' flower-basket*, which used to be credited to skilled Chinese or Japanese craftsmen, is nothing but the framework of a dead *glass sponge*. These lime and flint skeletons are composed of myriads of tiny bodies called *spicules*, made

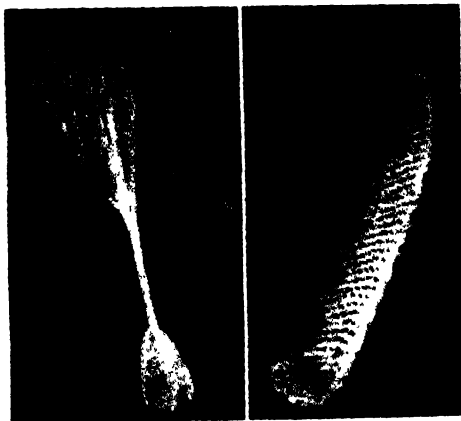
of a substance secreted by some of the cells. In the form of delicate threads, slender needles, or oddly-shaped crystals resembling snow crystals, these spicules intertwine to make the solid mesh of the skeleton.

Besides the limy and glassy skeletons, there is a third class, characterized by elastic, horny fibres resembling silk; and it is this variety that provides the absorbent bath sponge.

The Sponge of Commerce. Sponges are gathered for trade purposes in various ways. In some localities, especially the Mediterranean Sea, where they grow in very deep water, they are collected by divers. The fishermen off the reefs of Florida use the harpoon method. The men are sent out from the ship in pairs, one to manage the boat and the other to do the actual fishing. By means of a glass-bottomed bucket, the fisher can see to a depth of sixty or more feet, and when he discovers a sponge of fair size, he lets down his long forked pole and dexterously spears it.

The finest, softest sponges come from the Mediterranean, particularly from the neighbourhood of Turkey; the next best grade is the Red Sea product.

Fresh-water Sponges. Though the sponge is properly a marine animal, a certain branch



SPONGES FROM THE INDIAN OCEAN

Left: Glass rope. Right: Venus' flower-basket.

Photos: Visual Education Service

of the family has adapted itself to fresh water. It is to be found in ponds, rivers, and lakes in nearly all parts of the world, particularly where the water is quiet. One must look very closely to find these sponges, for they are only from $\frac{1}{2}$ in. to 1 in. long.

Scientific Names. The scientific name of Venus' flower-basket is *Euplectella aspergillum*; that of a

very common bath sponge is *Euspongia officinalis*. Fresh-water sponges belong to the genus *Spongilla*.

SPONTANEOUS GENERATION. The theory that living organisms can be produced from inorganic matter. In former days considered to provide the first step in evolution, the view is now discredited. See **BIOLOGY**.

SPOONBILL. At one time a common name applied to the shoveller (which see), but now given to a large stork-like bird which can easily be identified by its curious long bill, broadened at the tip, and by its white plumage. This bird breeds in suitable localities in central Europe and Asia. At one time it is said to have had breeding-places in south-east England, but at present it is only an occasional visitor.

Scientific Name. The spoonbill is of the family *Plataleidae*. It is *Platalea leucorodia*.

SPORE. A minute body borne by lower plants, such as algae, ferns, mosses, and lichens, which has the same function as a seed in higher plants—that of reproduction. Spore-producing plants are known as *cryptogams*, and are of two kinds, those containing green colouring-matter used in the manufacture of plant food (see **CHLOROPHYLL**), and those which must draw nourishment from other plants, or have other sources of organic

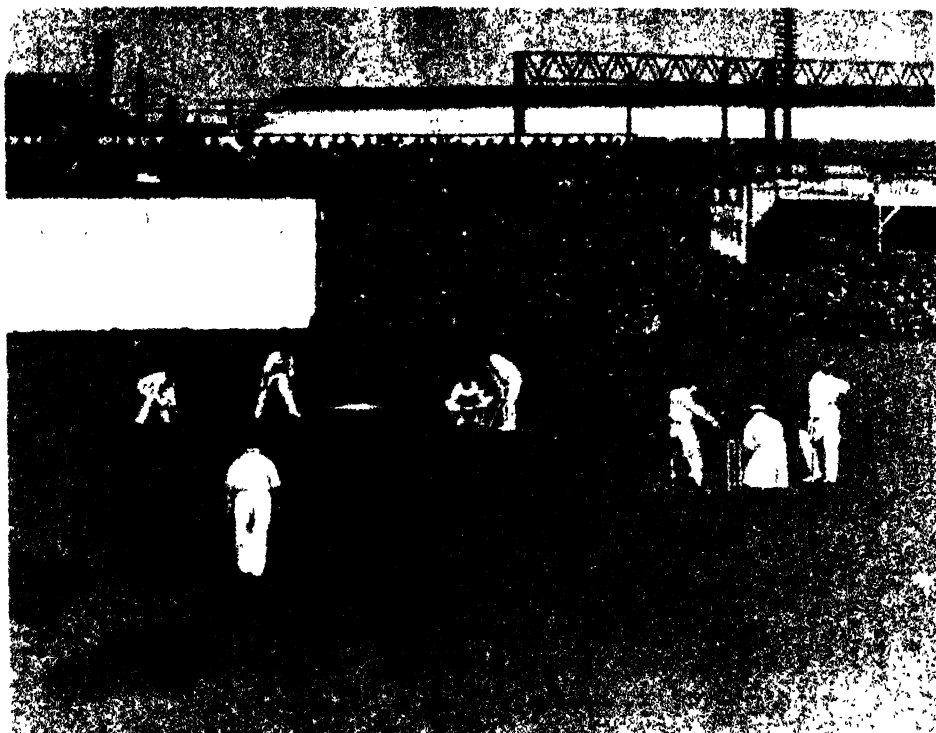


SPOONBILL STANDING ON A TURTLE
Photo: Barth Lane

matter. The latter organisms cause smut on corn, cotton wilt, wheat rust, apple blight, and the like, though mushrooms are



YANKEE STADIUM, NEW YORK, ONE OF THE GREAT AMERICAN ARENAS



THE GREAT ENGLISH SUMMER GAME: CRICKET-TEST MATCH AT OLD TRAFFORD, 1930

Photo: Central Press

also in this class. A typical spore is a single living cell, that is, a mass of protoplasm with differentiated nucleus and often with characteristic cell wall, and containing food materials. It germinates or develops in a fashion determined by the heredity of its kind and, to a certain extent, by the conditions surrounding it. See BACTERIA AND BACTERIOLOGY, CRYPTOGAMS.

SPORT. The origin of sport was religious. The ancient Greek games were held in honour of one or other of the gods, or as part of funeral or thank offering ceremonies. The most famous of these games was the Olympian. This started as a ceremony of purely local interest but gradually gained wider respect and importance, and eventually became a bond of union for all the Doric peoples.

The early Roman games were also held in honour of the gods, but in the latter days of the Roman Empire they degenerated. A professional element crept in and tended to lower the ideals of the games, for the Romans regarded the competition of a noble with the professional athletes to be effrontery. For instance, the competition of the

Emperor Nero was regarded as unworthy of kingship.

In England after the Norman conquest the nobles enjoyed some forms of sport, such as the chase, which had been introduced in Saxon days. The quarry was deer or wild boar, and dogs were used to assist in the chase, the technique being approximately the same as in modern fox-hunting. After the twelfth century, tilting with the lance was introduced, but the sports of the common people were largely forms of preparation for war. So much did this become the case that when certain sports threatened to interfere with the practice of archery, Edward III forbade them by statute, but the popularity of feats of strength and other forms of contest continued, and under Henry VIII there was a marked revival of sporting activity in England. The Stuart monarchs also encouraged sport, but the Commonwealth condemned them, and under Cromwell English sports and athletics practically died out. Their revival came in the nineteenth century.

Sports and Athletics. Among the leading sports of to-day, Football dates from the

beginning of the nineteenth century. Association rules (since lost) were formulated about 1849. William Webb at Rugby School, ran with the ball in his hands in 1823, but the Rugby game did not prosper until about 1860. The present name of Cricket dates only from 1685, but the origin of the game is earlier. Prizefighting had been common in the latter half of the eighteenth century, but had declined and become brutalized. From the reaction that set in, the modern sport of Boxing originated. An exact date (1866) may be assigned to the formation of the Amateur Athletic Club which drew up the "Queensberry" rules.

The first athletic meeting organized in modern times was held at the Royal Military Academy, Woolwich, in 1849; the contests between teams of athletes from Oxford and Cambridge universities started in 1864, and the English championships were started two years later. These latter contests are now under the control of the Amateur

Athletic Association which was formed in 1880. The modern Olympic Games, which are intended in some measure as international counterparts of the old Greek games, were instituted in 1896 at Athens, and are now held every four years. In 1894 the first of a series of meetings between English and American universities took place when Oxford met Yale. The contests now usually are between a team of athletes from Oxford and Cambridge universities on the one hand, and a team from those either of Yale and Harvard or of Princeton and Cornell on the other.

Perhaps the most ancient sports meeting which is still conducted is the Taitin Games, or Lughnasad, held in Ireland. It dates from about 3000 years ago.

Below is given a list of world records.

SPRAIN. A form of joint injury in which the tough, fibrous bands, or ligaments, which hold the joint in place, are torn in part or in whole. A minor sprain, involving stretching

LIST OF WORLD'S RECORDS PASSED BY INTERNATIONAL AMATEUR ATHLETIC FEDERATION, BERLIN

AUGUST, 1936

Event	Distance or Time	Name	Country	Where made	Date
100 yards	9.4 sec.	J. Owens	U.S.A.	U.S.A.	25/5/35
100 yards	9.4 sec.	J. Owens	U.S.A.	U.S.A.	20/6/36
100 metres	10.3 sec.	E. Peacock	U.S.A.	Norway	6/8/34
100 metres	10.3 sec.	C. Berger	Holland	Holland	26/8/34
100 metres	10.3 sec.	R. Metcalfe	U.S.A.	Japan	15/9/34
100 metres	10.3 sec.	R. Metcalfe	U.S.A.	Japan	23/9/34
200 metres					
220 yards	20.3 sec.	J. Owens	U.S.A.	U.S.A.	25/5/35
300 yards	30.0 sec.	J. Kovacs	Hungary	Hungary	6/10/35
400 metres	46.1 sec.	A. Williams	U.S.A.	U.S.A.	19/6/36
1500 metres	3 min. 47.8 sec.	J. E. Lovelock	N.Z.	Germany	6/8/36
2 miles	8 min. 58.4 sec.	D. R. Lash	U.S.A.	U.S.A.	13/6/36
20,000 metres	64 min. 00.2 sec.	J. Zabala	Argentina	Germany	10/4/36
25 miles	2 hr. 26 min. 10.8 sec.	M. Fanelli	Italy	Italy	21/10/34
2 hours	21 miles 698 yds.	J. Ribas	Argentina	Argentina	14/9/35
120 yds. Hurdles	14.2 sec.	T. Moore	U.S.A.	U.S.A.	14/5/35
120 yds. Hurdles	14.2 sec.	P. Cope	U.S.A.	U.S.A.	15/6/35
120 yds. Hurdles	14.2 sec.	R. Staley	U.S.A.	U.S.A.	15/6/35
120 yds. Hurdles	14.2 sec.	A. Moreau	U.S.A.	Norway	2/8/35
110 metres Hurdles	14.1 sec.	F. Towns	U.S.A.	U.S.A.	19/6/36
120 yds. Hurdles	14.1 sec.	F. Towns	U.S.A.	Germany	6/8/36
110 metres Hurdles	14.1 sec.	F. Towns	U.S.A.	Germany	6/8/36
200 metres Hurdles	22.6 sec.	J. Owens	U.S.A.	U.S.A.	25/5/35
220 yds. Hurdles	22.6 sec.	J. Owens	U.S.A.	U.S.A.	25/5/35
15,000 metres Walk	1 hr. 9 min. 4.8 sec.	A. T. Schwab	Switz.	Norway	20/6/35
High Jump	6 ft. 9½ in.	C. Johnson	U.S.A.	U.S.A.	12/7/36
Long Jump	26 ft. 8½ in.	D. Albritton	U.S.A.	U.S.A.	12/7/36
Hop, Step	51 ft. 9 in.	J. Owens	U.S.A.	U.S.A.	25/5/35
Hop, Step	52 ft. 6 in.	J. P. Metcalfe	Australia	Australia	14/12/35
Pole Vault	14 ft. 5½ in.	N. Tajima	Japan	Germany	6/8/36
Pole Vault	14 ft. 6 in.	K. Brown	U.S.A.	U.S.A.	1/6/35
Shot (both hands)	94 ft. 3 in.	G. Varoff	U.S.A.	U.S.A.	4/7/36
Shot (both hands)	96 ft. 7 in.	Z. Heljassz	Poland	Poland	18/8/35
Javelin	174 ft. 2 in.	J. Daranyi	Hungary	Hungary	28/9/35
Javelin	251 ft. 6 in.	W. Schroder	Germany	Germany	28/4/35
400 Relay	39.7 sec.	M. Jarvinen	Finland	Italy	7/9/34
		U.S.A. National Team		Germany	9/8/36
		J. Owens, R. Metcalfe,			
		E. Draper, F. Wykoff)			



SPORT AND ATHLETICS

1. Cycle racing. 2. Taking a hairpin bend in a motor-cycle race. 3. Shooting at Bisley. 4. Taking the water jump in a steeplechase. 5. The final of the 110 metres hurdles at the Olympic Games. 6. Competitors in the National Walking Championship. 7. Fräulein Mauermayer, world record maker, throwing the discus. 8. Throwing the javelin. 9. Fencing with the épée. 10. Runner breasting the tape in a relay race.

Photos: Fox; Photopress; Central

but not laceration, is sometimes called a *strain*, but these terms are commonly used interchangeably. Sprains may occur at any joint, but are most frequent at the ankle, owing to its bearing the weight of the body.

The joint in question is painful and rapidly becomes swollen, and any movement of it increases the pain; later, discoloration occurs, as in an ordinary bruise. It is often impossible to distinguish a sprain from a fracture without the help of X-rays.

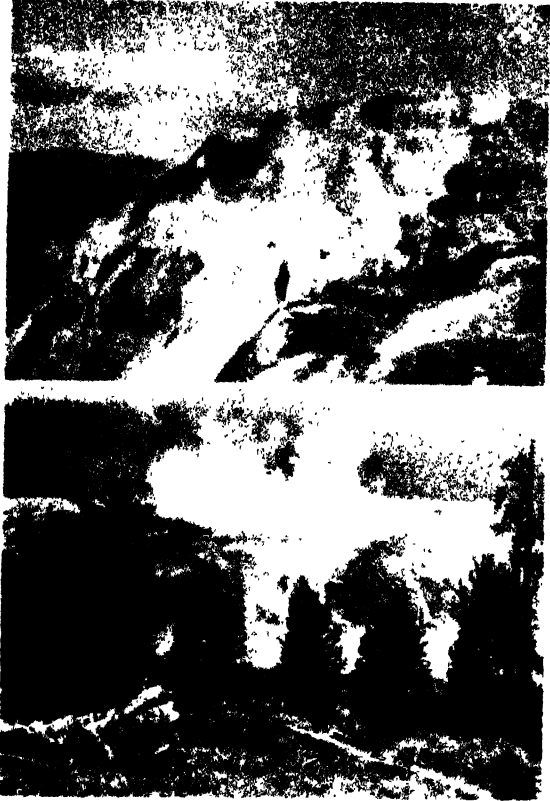
The swelling is caused by the escape of serum and blood into the tissues of the joint. As soon as possible after the accident, the joint and the limb for a few inches above and below are wrapped around with a thick layer of cotton wool, and over this a bandage is applied very tightly indeed, in addition the injured part, dressings and all, may be bathed in cold water. After thirty-six hours the tight bandage is replaced by adhesive strapping, applied in such a way as to support and protect the damaged joint where the fibres are torn. Some movement is allowed from the first, for this tends to prevent formation of adhesions, such as occurs under conditions of complete rest, adhesions cause limitation of movement and pain long after recovery is otherwise complete, and they have to be broken down and the full range of movement restored by active manipulation. Two extremely valuable adjuncts in the treatment are electricity, by means of the faradic current; and massage, administered with experience and skill.

SPRAT. A sea fish, one of the smallest species of the herring family, growing only about 6 in. long. It can be distinguished from young herring by the sharply notched edge of the abdomen. Sprats live in shoals along the European Atlantic and Mediterranean coasts. They are caught with bag nets or seines. The European sprat is *Clupea sprattus*.

SPRING. During a rainstorm, a part of the water soaks into the ground and filters downward until it reaches a layer of rock or clay, through which it cannot pass. This layer may come to the surface farther down the slope, and if the water finds a channel along which it can flow, it comes to the surface as a spring.

Hot and Cold Springs. The temperature of springs is nearly the same as that of the underground rock over which the water

flows. Cool springs have deep sources, whose temperature is not affected by climatic changes, and which varies but little throughout the year. On the other hand, a spring whose source is near the surface will be much warmer in summer than in winter. In volcanic regions, the water may come in contact with heated layers of rock, and



HOT SPRINGS IN THE CANADIAN ROCKIES

Photos Cherry Kearton

when this occurs, a hot or thermal spring is found.

Mineral Springs. Water, in filtering through the ground, dissolves carbonate of lime and various other minerals. Springs whose waters contain these substances in solution are known as *mineral spring*. Various gases, such as carbon dioxide, sulphuretted hydrogen, and nitrogen, are also found in the water of these springs.

SPRING. See SEASONS

SPRINGBOK. A species of South African antelope, the nearest ally of the true gazelles, so named from its habit of taking great bounds when running. Among the Dutch settlers it is known as *trekboek*, or *travelling*

buck. The springbok is the most slenderly built of all antelopes. Its coat is close and short, of a dull-brown colour, with a white stripe extending from the middle of the back to the tail. The horns curve in the shape of a lyre, and in the female are not so deeply ringed as in the male. The skin is valuable. See ANTELOPE.

Scientific Name. The springbok belongs to the family *Bovidae*. Its scientific name is *Antidorcas euchore*.

SPRUCE. The common name of a genus of evergreen trees belonging to the pine family. There are about thirty species, all native to



SPRUCE
Photo: E. J. Hosking

the northern hemisphere. Their extreme northern limit is beyond the Arctic Circle, their southern limit the Pyrenees, the Himalayas of Asia, and in North America, North Carolina and Arizona. Of the cone-bearing trees, the firs are most closely related to the spruces, but the cones of firs stand erect, while those of spruces hang downward. Their needles, too, are dissimilar. Those of firs are arranged in flat rows, while spruce needles grow thickly in spirals around the branches, pointing in all directions. The foliage of spruce is otherwise distinctive. The leaves are four-sided, an inch or less in length, and they are joined to the twigs by woody projections.

Uses. Spruce wood is extensively used for wood pulp in the paper-making industry. The timber is strong, light, and elastic, and

admirably suited for masts and spars of ships, boxes, and sounding-boards of musical instruments and aeroplane frames.

Resin, tannin and turpentine are products of spruce bark. See FIR.

Scientific Names. The spruce genus is *Picea*, family *Pinaceae*. The white spruce is *P. canadensis*, the black, *P. nigra*; the red, *P. rubra*; the Sitka, *P. sitchensis*, the Norway, *P. excelsa*. The Douglas spruce, or fir, is *Pseudotsuga douglasii*.

SPURGE FAMILY, OR EUPHORBIACEAE. *is for be ay' se e*. A family of herbs, shrubs, and trees including about 4000 species, many of which are the source of very useful products. Castor oil, croton oil, cassava, and rubber are among these products. The family includes also several ornamental plants, among them the poinsettia. Members of the spurge group bear small, inconspicuous flowers, but these sometimes have bracts (see BRACT) of very brilliant hues. A biting, milky, and, in some species, poisonous juice is a characteristic of the plants.

SPY. In military usage, a term defining any person who abandons the uniform or distinctive badge of his service, in order to mingle with the enemy, for the purpose of obtaining information of value to the army he is serving. It is clearly agreed in international warfare that a soldier in uniform, no matter under what circumstances he is taken, cannot be considered a spy. Civilians openly carrying messages are not spies. Aviators who reconnoitre or "spy out" the position of forces are not spies. A spy is one who acts clandestinely or under false pretences. To be condemned as a spy, a person must actually be taken within the lines of the enemy in disguise, or while pretending to be other than what he really is. Death by hanging or shooting is the usual punishment for all condemned spies.

The term is also applied in time of peace to those who try to collect information in one country which would be valuable to another country. Special laws deal with such cases. See ESPIONAGE.

SPY WEDNESDAY. See HOLY WEEK.

SQUADRON, *skwad' ron*. A naval and military term describing a division of war-ships, of a regiment of cavalry or armoured cars; or of the detachments of Royal Engineers and Royal Corps of Signals, working with mounted troops.

A naval squadron may consist of from two to eight war vessels, under the command of a junior flag officer.

In the British Army, a squadron is commanded by a major, and consists of three or four troops. Each cavalry troop has three sabre sections and one light machine-gun section.

A *field squadron* comprises the Royal

Engineers of a cavalry formation. A *machine gun squadron*, or *signal squadron*, is similarly employed with mounted troops.

The word is derived from the French *escadron*.

SQUALL. The term applied to a sudden but not prolonged increase in the force of the wind. A squall may be said to be due to meteorological causes, and is liable to accompany a change of wind direction. During a squall the wind, with suddenly increased force, may blow from 50 to more than 100 miles an hour. The most common form of squall is that known as a line squall. It is generally accompanied by rain or hail and associated with a sudden drop in temperature, and it occurs when currents of warm and cold air meet in what is known as a V-shaped depression. During the passage of the squall the wind often veers, that is to say, moves round clockwise to a direction generally more westerly or north-westerly. Thunderstorms are often preceded by line squalls, since these storms are closely related to the meeting of air currents at widely different temperatures.

SQUARE. A plane figure having four equal straight sides and four right angles.

The number of square units in a square is the products of the number of units in the length and the number of units in the width, as in any rectangle. But since the length and width of a square are equal, the area is found by multiplying one side by itself, or by squaring one side. The square of a number is indicated by placing the exponent 2 to the right and above the figure (see below).

SQUARE ROOT. On a line 4 in. long build a square. The area of the square is 16 sq. in. On a line 9 ft. long build a square. The area of the square is 81 sq. ft. The drawing of squares on squared paper shows the relation of the area of a square to one of its sides: the number of square units in the area is equal to the number of units in one side multiplied by itself. This product is called "the square" of the number. "The square" is used to designate the product obtained by multiplying a number by itself, whether or not that product is thought of geometrically as a square. The square of a number is indicated by a little figure called an *exponent*, thus, $4^2 = 16$; $9^2 = 81$.

The above are read: 4 squared = 16; 9 squared = 81; or the square of 4 = 16, the square of 9 = 81.

Finding the line upon which a square is built, or finding what number multiplied by itself gives a certain square, is called "finding the square root of the number"; that is, finding the line or number out of which the square grows. And, as is usual in mathematics, there is a sign used to indicate what

is sought; thus, $\sqrt{25}$ stands for the number which multiplied by itself makes 25. The sign is called the *radical sign* or *root sign*.

SQUASH RACKETS. To Harrow School seems to belong, with the introduction of a soft ball, the credit of originating the "squash" type of rackets, in which game the flight of the ball is so swift that the onlooker becomes amazed at the dexterity of players. One reason for the remarkable expansion of squash lies in the fact that devotees of other games have discovered in it a rapid road to good physical condition. The rules of squash rackets are much the same as those for rackets, but scoring in the championship is based on the best of five games of nine points each. The standard court is 32 ft. long, 21 ft. wide, and 15 ft. high, with a wooden floor in a covered court and cement floor in an open court.

SQUID. A type of sea mollusc having an internal shell and ten movable arms about the mouth. The *common squid* has a long, pointed body, with two fins at the posterior end, united at the back. Two of its ten arms are longer than the other eight, but all have rows of sucking organs. It has a large head, and a mouth equipped with two horny jaws and a rasping tongue. The body of the squid is spotted with several tints, and it can change its colour at will to correspond with its environment. Like others of its family, it has an ink bag from which it ejects a dark fluid to discolour the water when fleeing from an enemy. Aided by their sucking disks and movable arms, the squids successfully prey on small fish, and they themselves are eaten by fish, eels, dolphins, and sea birds.

The common squid is from 8 in. to 20 in. in length, but there are giant specimens off the Newfoundland coast, with bodies from 8 ft. to 10 ft. long and tentacles attaining a reach of 40 ft.

Scientific Names. Squids belong with the nautilus, cuttlefish in the class *Cephalopoda* of the sub-kingdom *Mollusca*. The common squid is classed as *Loligo pealii*, family *Loliginidae*.

SQUILL. The name of several plants with bulbous roots, belonging to the lily family. A species known as the *sea onion*, which grows in countries around the Mediterranean, produces bulbs sometimes weighing 4 lb. and of medicinal value. They are collected in August. The outer husk is removed, and the bulb is sliced and dried in the sun. The drug made from these bulbs is generally used in the form of syrup and the tincture of squill. It stimulates the heart and has decidedly irritating qualities, affecting particularly the stomach, intestines, and bronchial tracts.

Squill is sometimes used in chronic bronchitis, but its use is decreasing.

Scientific Name. Squill belongs to the family Liliaceae. Its botanical name is *Urginea maritima*.

SQUINT, OR STRABISMUS, *strā bis' mus*. Under normal conditions, the two eyes can be directed toward an object with the same axis of vision. There are six muscles on each side for this work—attached above and below and on each side of the eyeball. Injury to one or more of these muscles causes the affected eye to turn out of its normal position. Sometimes both eyes are affected. That form of squint is most common in which the eye or eyes seem to be looking at the nose. Neglect of such condition often causes blindness in one or both eyes. Wearing correct glasses helps in many cases. Even very young cross-eyed children should be fitted with proper glasses. Sometimes the defect is corrected by operation. See EYE.

SQUIRE, OR ESQUIRE. The second step toward knighthood (which see)

SQUIRREL. A small arboreal rodent with a very extensive distribution throughout the world. Species are found in most countries, except Australia and the island of Madagascar.

There are two species in Britain, the native brown squirrel and the grey squirrel, which has been introduced comparatively recently from America.

Squirrels are well adapted for living in trees. The long bushy tail, almost equal in bulk to the rest of the animal, makes an effective rudder and balancing organ when the squirrel moves rapidly from branch to branch. The tail also makes a warm blanket in the winter. It has been said that the main use of the tail is to deceive enemies, who may pounce and obtain only a bunch of fur.

The squirrel leaps considerable distances, and consequently the hind legs are very well developed. The fore-legs are small and are used more as "hands" for holding food, etc., a characteristic of many species of rodent.

The nests or "dreys" are built in trees. There are generally two kinds, an ordinary living nest and one in which the young are reared. The former is often in quite a conspicuous situation, in the fork of a tree or out on a strong branch; the latter is more carefully concealed, often in an evergreen.

Squirrels are not really hibernating animals, nor do they lay up a store of food for winter needs as intelligently as they are popularly believed to. It is true that in the autumn, when food is plentiful, they consistently bury any surplus to their immediate requirements, but it is done very unmethodically. It is buried anywhere, and there is never any large hoard.

During the cold winter spells, squirrels remain more than usual in their warm nests,

but they are not really hibernating. A squirrel may be found at any time during the winter exploring a bare patch of ground in the hope of finding nuts and acorns that may have been buried there.

Squirrels are vegetarians in their diet, but they sometimes eat eggs, and even young



SQUIRREL

Photo: U. & U

birds. The grey squirrel is a bigger offender in this respect. It is gradually displacing the brown squirrel and becoming a definite pest.

Scientific Names. The brown squirrel is *Sciurus vulgaris*, the grey *S. carolinensis*

SRINAGAR, *srin a gur'* See INDIA, KASHMIR.

STABILIZER. See GYROSCOPE.

STADIUM, *stay'dyum*. Originally, the foot-race course at Olympia, Athens, and other places in Greece where athletic contests were celebrated. The name in modern usage refers to a great uncovered structure, with seats arranged in tiers, from which spectators view athletic meetings, and other sports.

The stadium was also a measure of distance among the Greeks. It was the distance between the terminal pillars of the stadium at Olympia, and was the equivalent of 606 ft. 9 in., in English measurement.

STADTHOLDER (*stah't'*). See NETHERLANDS (History)

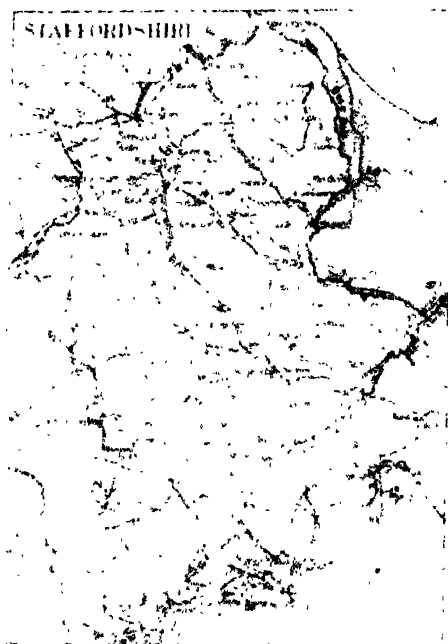
STAFF. See MUSIC.

STAFFORD. The county town of Staffordshire, Stafford is a borough and market town with a population of 29,485. It lies in the middle of England, in rich pasture country, and is an important railway junction on the L.M.S.R. line, 133 miles from London and 23 miles from Birmingham. The history of Stafford goes back over a thousand years, its early name being *Bethnei*. It is mentioned as a walled town in Domesday Book under the name of *Statford*. In Norman times it had a castle. Its first royal charter was granted by King John in 1206. The shoe

trade is Stafford's staple industry. The town was the birthplace of Izaak Walton.

STAFFORDSHIRE. A midland county of England with an area of 737,886 acres and a population (1931) of 1,431,175.

Physical Features. Staffordshire is best-known for the two manufacturing areas which fall within its boundaries—the Potteries round Stoke-on-Trent in the north, and the Black Country round Wolverhampton in the south—two areas which owe their prosperity



to rich coal measures—the north and south Staffordshire coalfields respectively.

Physically, the county falls naturally into two divisions—an upland district in the north-east, and a lowland district occupying the remainder. The boundaries of the former are well-defined and include everything to the north of a line drawn from the confluence of the Churnet and Dove to Kidsgrove on the Cheshire boundary. This is a district of high moors and deep-cut valleys, and swift rivers which flow into the Dove.

By contrast, the remainder of the county has been classed as lowland, but it is rarely level. Rather, it is a gently undulating alluvial plain affording excellent pasturage. One area in particular stands out from the general level of scenic excellence—that of Cannock Chase, one of the most extensive districts of common-land in the Midlands.

The principal rivers of the county are the Trent, and its tributaries the Dove and Tame.

History. The earliest race of men known to have inhabited this district is the Neolithic. The country was little developed by the Romans, but Watling Street passed through it from end to end. There are traces of only four Roman settlements of which Letocetum is one, whilst the site of another is identified with the modern Uttoxeter.

After the withdrawal of the Roman troops the county fell within the province of Mercia, and the district first gained prominence from the establishment of the episcopal see at Lichfield in the seventh century. About the same time Tamworth rose in prosperity, due to the royal favour of King Offa, who built a palace there. The ninth century witnessed several invasions of the Norsemen or Danes. At the Norman Conquest the county still appears to have been impoverished.

Both in the Wars of the Roses and in the Great Civil War there was much activity in the district. In the former the Lancastrian cause was generally favoured. In the latter the great landowners were more or less equally divided between the Royalist and Parliamentary causes. As a whole the county favoured the Roundheads. Numerous castles were held on behalf of the king, but, in particular, Dudley and Tutbury held out until the late spring of 1646.

Later centuries have witnessed an extremely rapid growth in wealth, and a correspondingly rapid increase in population consequent on the working of the coal mines and the attendant heavy industries. The post-war years have brought much unemployment in these same industries. At the present time the county returns eight members to Parliament.

Climate. Considerable variations of climate within the county follow the physical formation. Thus the north-east is both colder and wetter than the south-west, certain stations in the lowlands having an average rainfall of less than 25 in., whilst near Leek the average annual rainfall approximates to 40 in. The mean annual temperature is below that of the country as a whole (about 46° degrees).

Communications. The majority of the railway lines are operated by the L.M.S.R., with the exception of a few lines in the south which belong to the G.W.R. From Birmingham lines radiate in every direction, and there is a network of railways connecting towns such as Tamworth, Lichfield, and Wolverhampton. Similarly, in the north, the district between Leek, Stoke and the pottery towns generally is very well served. Other important lines radiate from Stafford to Wellington, to Wolverhampton, to Lichfield, to Uttoxeter and to Crewe. Union



STAFFORDSHIRE

1. Pottery kilns at Burslem. 2. Saxon Cross, Leek. 3. Mill Dale in the valley of the Dove. 4. Haselour House, an Elizabethan mansion. 5. Entrance to ancient cave-dwelling, Kinver. 6. Tamworth, the River Tame and Castle. 7. Dancers of the ancient Horn Dance at Abbots Bromley. The dance is thought to be a relic of the ceremonial declaration of forest rights

Photos: Fox; George Long, Taylor

Canal carries much traffic from Stoke and Burton.

Agriculture and Industries. The predominance of the industrial centres has resulted in agriculture being somewhat neglected. In the last hundred years the population of many of the country towns has diminished, whilst that of the county as a whole has increased nearly fourfold. Small quantities of wheat are raised, but oats and barley are the principal crops, followed in importance by root crops and market gardening products which are grown to supply the demands of the industrial towns. The pasture lands of the Valley of the Trent are valuable, and Stafford cattle have a high reputation, both for stock and for dairy purposes. In addition, pigs are being reared in increasing numbers.

The size and number of the heavy industries are immense. These have grown round the two principal coalfields and have their beginnings over 500 years ago. Apart from coal-mining itself, numerous other minerals are worked, including iron ore, limestone and sandstone, whilst the large amount of clay raised is utilized in the pottery industry. This latter, also, is of considerable antiquity and was associated historically with Burslem, but Staffordshire ware is now produced in all the surrounding towns, particularly at Stoke and Hanley, included in the borough of Stoke-on-Trent. The iron and steel trades employ an even larger number of operatives, and practically every class of goods is manufactured in one of the towns of the Black Country from heavy engines to tinnacks. The other two industries of major importance are the silk industry at Leek and the brewing industry at Burton.

Antiquities. Neolithic barrows in the north-east moorlands and the Devil's Ring at Muckleston are the two principal prehistoric antiquities. At Seisdon a number of holes in the ground are reputed to be the remains of some form of Celtic pit dwelling. Of the Roman occupation Watling Street is the most notable reminder. There are seven sites of earthworks in all, some of which may be of Roman or British origin, whilst some are much earlier. Bury Ring at Haughton and Kinver Edge are two of the largest. Norman castles and medieval religious houses were both numerous, but none has survived in entirety. Tutbury Castle is by far the most interesting historically, and was the scene of several sieges during the Middle Ages, but the ruins of Dudley and Tamworth are on the whole more picturesque. Croxden Abbey, a Cistercian house, is beautifully situated and moderately well preserved, whilst at Tutbury and Lapley the present parish churches have incorporated consider-

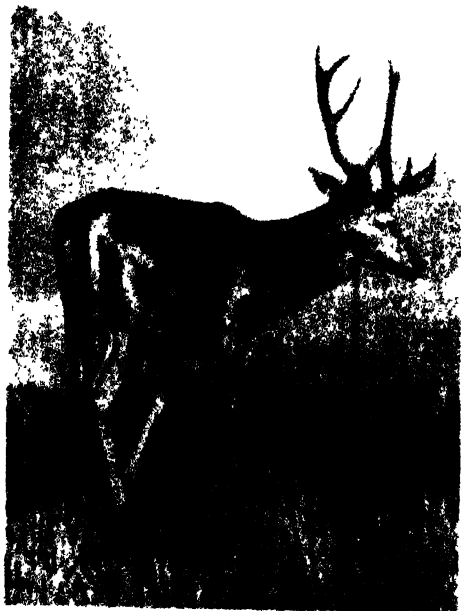
able fragments of the original Benedictine priory churches. Caverswall Castle is a magnificent example of Domestic architecture in the Jacobean style.

Chief Towns. The county town is Stafford (which see), and Burton, Smethwick, Stoke-on-Trent, Walsall, West Bromwich, Wolverhampton, and Lichfield will also be found in their alphabetical position. The other boroughs are *Newcastle-under-Lyme* (population 23,246 in 1931, area 1766 acres), the seat of an early twelfth-century castle and a borough since the later years of the twelfth century. Recently it has increased in size owing to its position on the fringe of the pottery district.

Tamworth (area 284 acres; population 7510 in 1931), situated on the borders of Warwickshire and one of the most ancient towns in the county—the former capital of King Offa. The castle, which has been greatly restored, still shows fragments of a Saxon wall and considerable portions of the early Norman building.

Wednesbury (area 2025 acres, population 31,534 in 1931), a modern industrial town which, like Tamworth, can also be traced to a Saxon foundation. It possesses numerous factories engaged in the iron and steel trade.

STAG. The male of the red deer, the common deer of Europe. A full-grown stag



STAG (RED DEER)
Photo: John Kearton

stands about 4 ft. high at the shoulder, and has branching horns 3 ft. in length.

The name *stag* is also applied in a general way to males of other species of deer. See DEER.

Scientific Name. The stag belongs to the family Cervidae. Its scientific name is *Cervus elaphus*.

STAG-BEETLE. The name of a family of beetles in which the males of certain species have odd horn-like processes on the mandibles, not unlike the horns of a stag. In some cases, these projections are nearly as long as the body of the insect. They are among the largest beetles found in Great Britain. See BEETLE.

Classification. The scientific name of the stag-beetle family is *Lucanidae*.

STAGE. See DRAMA; THEATRE.

STAGHOUND. A dog identical with the foxhound. Formerly, only the large-sized dog hounds were used for the stag, but now there is no difference in size, and both sexes are used. Hardiness and stamina are the chief requirements, for a three- or four-hour run is not unusual. The stag is hunted in August and September, primarily in the West of England, and particularly on Exmoor, where the red deer abounds. The fallow deer is hunted in the New Forest. Foxhounds run altogether, in a pack; staghounds in one line, often mute.

STAINED GLASS. See GLASS.

STALACTITES AND STALAGMITES, *stal' ah tites, stal' ag mites*. Curious and beauti-



THE "KING'S CHAMBER" IN THE CARLSBAD CAVERNS, NEW MEXICO
Photo: Santa Fe Lines

ful deposits, ordinarily of calcite, formed in caves and sometimes under stone bridges and arches. Water, percolating through pores and crevices in limestone, takes some calcium carbonate into solution. When it



"THE TRANSFORMATION SCENE"
Stalagmites and stalactites in Cox's Cave, Cheddar Gorge.
Photo: Frith

emerges into a cave and drips from the roof or trickles down the walls, it evaporates and deposits the dissolved material. Stalactites hang from the roof and are formed like icicles, which they resemble; stalagmites, which rise from the floor like inverted icicles, are built up by evaporation from the water falling from above. Sometimes the two forms join in columns and clusters; fantastic curtains and flutings are also formed by water flowing down the walls.

STALIN, *stahl' in*, JOSEPH V. (born 1879). Secretary-general of the Communist Party of Soviet Russia. In this position he has the powers of a dictator, and by his forceful and ruthless methods he has justified Lenin's name for him, "the man of steel." He was born Iosif Dzhugashvili, the son of a factory worker. While a student in Tiflis, he joined the Social Democratic party. After 1901, he was a so-called professional revolutionist,

and two years later was exiled to Siberia. Five times between the years 1904 and 1917 he escaped from exile, only to be recaptured and imprisoned again. Freed from a Siberian prison by the February Revolution of 1917, he took an active part in the subsequent upheaval. Following the revolution, he edited several Bolshevik newspapers. In May, 1917, he was elected a member of the Central Executive Committee of the Communist



STALIN
Sculptured head
Photo: Fox

Party; later he succeeded Lenin as general secretary.

The fact that Stalin's mature life has been spent among the working classes has given him an understanding of the masses that forms one of the chief sources of his great power over Communist Russia. He was the driving force in the consummation of the first Five-Year Plan of the Soviets which was completed in 1932. In 1936 and 1937 certain plots against his life was revealed, and Zinovieff, Kameneff, and many other old Bolsheviks were convicted and executed. Stalin thus remained almost the last of the original group of revolutionaries, and his position was further strengthened. He is the author of several books on political questions. Among those which have been translated

are *Problems of Leninism*, *The Opposition*, *The Path to October*, *Lenin and Leninism*, and a *Collection of Articles on the Problem of the Minor Nationalities*. See RUSSIA.

STALINGRAD. See RUSSIA.

STALYBRIDGE. See CHESHIRE.

STAMBOUL, *stahm buhl'*. The Mohammedan quarter of Constantinople (which see)

STAMEN. See FLOWER.

STAMFORD. See LINCOLNSHIRE.

STAMFORD BRIDGE, BATTLE OF. See HAROLD, OR HARALD (III, Norway).

STAMMERING AND STUTTERING.

These terms are used somewhat interchangeably in describing disordered speech. More correctly, stammering means hesitation in speech, with some tendency to repetition of words or sounds, and some tendency to wrong pronunciation. Stuttering refers to hesitations in which there is some spasm of the mouth muscles, and, at times, grunting, due to contractions of the muscles of expression. Many persons have these speech defects as the result of serious mental defects. More frequently, however, defective speech appears in children of good mental development, but lacking somewhat in emotional stability. There is no abnormality in the vocal cords, mouth, pharynx, nose, or muscles of speech.

Stutterers commonly sing and recite poetry without any speech disorder, since they are acquainted with the words, are helped by the rhythm and by the context.

Treatment. Treatment consists principally in teaching poise, self-confidence, courage, self-forgetfulness, and how to synchronize thought and speech.

STAMP, SIR JOSIAH CHARLES (born 1859), British economist and statistician. He entered the Civil Service at the age of 16, and was attached first to the Inland Revenue. He rapidly rose to be Assistant Secretary (1916). He resigned in 1919 in order to devote himself to business, and he held in succession directorships of Nobel Industries and Imperial Chemical Industries. He served as a member of the Senate of London University from 1924-1926, and was for various periods on Boards of Examiners of this and other universities. After the War, the Government made abundant use of Sir Josiah Stamp's expert knowledge of statistical science, particularly in relation to finance, taxation, and War reparations. Among the important offices held by him in 1936 were the Presidency of Abbey Road Permanent Building Society, the chairmanship of the London, Midland and Scottish Railway, and a directorship of the Bank of England. Innumerable books and essays on economics have come from his pen,

including *Fundamental Principles of Taxation*, *Papers on Gold and the Price Level*, *Financial Aftermath of War*, and *Statistical Studies*.

STAMP ACT. The growing prosperity of the colonies in America, and the increasing debt of the mother country, induced the British Ministry in 1764 to attempt to raise revenue in America. The main purpose was to make the colonies self-sustaining. In March, 1765, the Stamp Act was passed, imposing a stamp duty on all commercial papers, legal documents, and newspapers. Although the colonies had signified their willingness to raise money to assist in paying the debt incurred by England in the French and Indian Wars, they denied that Parliament had the right arbitrarily to impose a tax upon them, since they were not represented in that body.

Though the act was repealed in March, 1766, the right to tax the colonies was reiterated. See GEORGE III.

STAMPS AND STAMP COLLECTING.

Stamps, printed or embossed, are authorized by law to be affixed to papers or documents to furnish evidence of compliance with revenue laws. Stamp duties were first imposed by the Dutch in 1624. In England the plan was first resorted to in 1694, to raise money for carrying on a war with France. The subject of stamps attesting payment of taxes is of some historical interest; it was the passing of the Stamp Act of 1765 by the English Parliament that led directly to the Revolutionary War in America.

The form of stamp with which people of all countries are most familiar is the postage stamp. When Rowland Hill introduced cheap postage, and it was clear that the old system of collecting the postage from the receiver of the letter was quite impossible, special envelopes and adhesive labels were introduced for sale to the public. They were soon rejected, however, in favour of the postage stamp. The stamps proved useful models for other countries, and when improved by the introduction of the perforation, proved eminently satisfactory for their purpose. The stamp was in time adopted by all civilized countries.

Stamp Collecting. The hobby of stamp collecting originated soon after the issue of postage stamps, though they seem to have been accumulated at first for decorative purposes and even for covering walls and ceilings of rooms.

It was about 1860 that Philately—the study and orderly collection of postage stamps—as distinct from mere stamp accumulating, really began, and for some time the French seem to have been chiefly inter-

ested. They were the first to catalogue stamps, and to study perforations, watermarks, and other matters of interest to the more "advanced" collectors. The first English catalogue was issued in 1862, and from that time the hobby spread rapidly the world over. The term "philately" was coined by a French collector, and philatelic societies came into existence. The present vast literature on the subject then had its beginning, and improved types of stamp albums were continually being produced.

The collection and study of stamps is sometimes considered as merely a hobby. Far from being valueless, it is a pastime of great interest and educational value. If, as in Great Britain and the British Empire, the head of a ruler appears on the stamp, it is soon learnt who the ruler is. Other stamps show local views, natives, animals, plants, characteristic devices in heraldry, etc. A great number and variety of historical scenes and incidents have been depicted or referred to on postage stamps, from the throne of Solomon to the Disarmament Conference. Geographical knowledge is an obvious attainment of the philatelist, whilst some countries' issues illustrate famous men and women, zoological and botanical specimens, religious beliefs, industrial and commercial resources, etc.

Most collectors begin their study with general collections, made up of stamps of all the countries they can obtain. Later, certain kinds of stamps or certain countries appeal more strongly, and the collector begins to specialize. He may confine his attention to a group, such as the states which make up the British Commonwealth of Nations, or he may gradually narrow down the field to a single country. Many collectors now study stamps from the pictorial angle alone, forming "travel," "zoo," "literary" and other collections on this basis. Air mail stamps are now an attraction to numerous collectors.

Rare Stamps and Great Collections. The rarity of a stamp is determined not by its age but by its scarcity. The most valuable of all stamps is the One Cent issue of 1856 of British Guiana, of which only one copy is known to exist. This specimen has changed hands for over £7000. Other popular rarities are the penny and twopenny "Post Office" Mauritius of 1847. There are quite a number of postage stamps of which from one to ten specimens only are known, but popularity is needed as well as rarity to place a stamp in the highest rank as regards price. Other extremely valuable stamps are the first issues of Hawan (Sandwich Islands), Moldavia, certain varieties of the triangular issues of the Cape of Good Hope, and

certain stamps on which there are errors in printing.

Many of the rulers of European countries are keen philatelists. The late King George V was Patron of the Royal Philatelic Society, and had a magnificent collection of British Empire stamps.

One result of the great interest taken in postage stamps and the demand for the rarer issues was the appearance of forgeries, fictitious "stamps," "doctored" stamps and other frauds. The leading experts of the stamp world are banded into committees (such as those of the Royal Philatelic Society and the British Philatelic Association) which wage relentless war against the forger and faker and from which the collector may obtain opinions on doubtful specimens.

STANDARD OF LIVING. See SOCIOLOGY

STANLEY, SIR HENRY MORTON (1840-1904). Journalist and explorer, born at Denbigh, Wales, and baptized under the name of JOHN ROWLANDS. He emigrated to New Orleans when about eighteen. There, a merchant, Henry Morton Stanley, adopted him. At the outbreak of the War of Secession, he joined the Confederate army. After some years of travel in Europe, North Africa, and the East, he became a newspaper correspondent, and in 1870 was commissioned to "go and find Livingstone." Embarking for Africa, he



SIR HENRY STANLEY
Photo Brown Bros

reached Zanzibar and set out from there in March, 1871. He pushed on to Ujiji, on Lake Tanganyika, where, in November, he found Livingstone. His first speech when he saw the veteran explorer was characteristic. "Dr Livingstone, I presume?"

In 1874 he returned to Africa and set out from Zanzibar in November, 1874, and pushed into the interior, sailing about Victoria Nyanza before beginning his perilous enterprise—a journey down the Congo, from its source to its mouth. He emerged on the Atlantic coast in August, 1877.

A direct result of this exploration of the Congo was the founding of the Congo Free State. In 1886 he visited the Egyptian Sudan, and he again crossed the continent from coast to coast.

In 1892 he was renaturalized as a citizen of Great Britain; was elected to Parliament in 1895 as member from North Lambeth,

and in 1899 was knighted for his services in Africa.

STANLEY FAMILY. See DERBY, EARLS OF.

STANOVOI, stah no voi'. MOUNTAINS. A range of mountains in Siberia, about 2500 miles long, running from the Mongolian frontier in a north-easterly direction, and terminating at East Cape on Bering Strait. An offshoot extends in a southerly direction through the peninsula of Kamchatka. The greatest height is little over 8000 ft. above sea level. As far north as the parallel of 60°, the lower slopes are densely forested, but farther north they become bare and desolate. The whole range is rich in minerals, but it is practically undeveloped.

STAPES, staj' peez One of three tiny bones in the cavity of the middle ear.

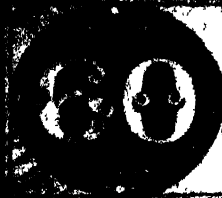
STAPHYLOCOCCI, staf' il o koki' se Term applied to bacteria that are arranged in rows or clusters. They give rise to abscesses and boils.

STAR. The night sky is spangled with many glittering points of light. Careful watch will show that some of them are, night by night, changing their places among their neighbours; these are the planets, or "wandering" stars. See PLANET.

The others are called "fixed" stars.

The ancients recognized that the fixed stars lie far beyond the planets; but Sir Isaac Newton was the first to recognize what an enormous gulf separates them. After discovering the law of "universal gravitation" he saw that the absence of any appreciable attractive force between the Sun and the stars, indicated by their fixity, proved that they were far too remote to be shining by reflected sunlight, like the planets. Hence they are self-luminous, like the Sun, and presumably comparable with it in splendour. Newton conjectured that Sirius, the brightest star, might be 100,000 times as remote as the Sun; this was a good guess, but actually Sirius is at five and a half times Newton's estimated distance. The nearest star is at half the distance of Sirius. With more exact knowledge of stellar distances has also come the recognition that a number of distant stars, like the North Pole star and Castor, are actually *multiple stars* having two or more components revolving round a third, and that some multiple systems have two or more centres.

Measuring Stellar Distances. The straightforward method utilizes the fact that the Earth revolves round the Sun, the diameter of its orbit being 186 million miles. Both the Sun and the star are in motion; this produces a steady progression in a straight line; the Earth's orbital motion makes the star appear to describe an ellipse, the counterpart



SOME EARLY STAMPS



Lithuania 1864



Queen Victoria 1840



35



Blackburn



Pasteur

PORTRAIT

NUMERAL

STAMPS



1881



Temple of the Tooth

PICTORIAL STAMPS



FOUR MODERN DESIGNS



NEW STAMPS

TYPES OF POSTAGE STAMPS

Photo: Stanley Gibbons Ltd.

of the Earth's orbit as seen from the star. Observation for a year or more permits the two motions to be separated, and gives the angle subtended by the diameter of the Earth's orbit at the star. The star's "parallax" is defined as half this angle, or that subtended by the radius of the Earth's orbit; the distance of the star in terms of this radius is found by dividing 206,265 by the parallax in seconds. The largest known parallax is $0''.78$; it is that of Proxima Centauri, a faint remote companion of Alpha Centauri, probably revolving round it in about a million years. The distance of Proxima is 264,000 times the Sun's distance, or 25 millions of millions of miles. Stellar distances are often given in "light-years"; light travels 5,880,000 millions of miles in a year; Proxima's distance is 4.2 light years.

The first fairly trustworthy measures of stellar distances were made a century ago. Henderson found for Alpha Centauri's distance 3.26 light-years; Bessel found for 61 Cygni 10.4 light-years; Struve found for Vega 12.4 light-years, the values given by modern measures are 4.30, 10.9 and 26.3 light-years respectively. The accuracy of such measures has vastly increased, mainly by the introduction of photography, and it is now possible to obtain fairly accurate measures of distance up to 300 light-years.

Indirect Methods. Several are used for greater distances. One is based on the "Proper Motions" of the stars; they are not really fixed, and the motions of thousands of them have been determined by careful telescopic measures. It is obvious that rapid motion is an indication of nearness; in fact Struve chose 61 Cygni for measurement, because of its rapid motion of $5''.2$ annually. In cases where several stars are travelling together, like five of the seven stars in the Plough, the method gives good results.

Another method is that of "spectroscopic parallaxes." Before explaining the method, the term "absolute magnitude" needs explanation. The light received from a star depends both on its real brilliance and on its distance; if we know the distance we can calculate how bright it would look at the standard distance, which is taken by convention as $32\frac{1}{2}$ light-years, the magnitude at that distance is called the star's absolute magnitude. Now on examining the spectra of stars of known distance, it is found that certain spectral lines show differences of intensity depending on the star's absolute magnitude; examination of these lines in the spectra of other stars gives a clue to their absolute magnitude; comparison of this with the observed magnitude determines the star's distance, remembering that the light

varies as the inverse square of the distance; thus at double the distance it is reduced to a quarter, at three times the distance, to one-ninth, and so on.

A very effective method of determining the distance of very remote objects was discovered by Miss Leavitt. There are many stars, known as "variables," which change periodically in brightness. Miss Leavitt studied a particular class of these, called "cepheid variables" from the star Delta Cephei, which was taken as a type of the class. She found that cepheids with the same absolute magnitude have also the same period of light-variation; it follows that if we observe the period in which a cepheid accomplishes its light-changes we can deduce its absolute magnitude; comparison of this with the observed magnitude determines the distance.

Another method available for distant stars, is based on a study of the lines due to sodium and calcium in their spectra. In some stars these spectral lines indicate a different rate of motion from the other lines in the spectrum. It is concluded that the gases producing these lines are not in the star's atmosphere, but are diffused throughout space. On this assumption the intensity of the lines determines the distance traversed by the light, provided that the density of the diffused gas is uniform, which appears to be the case. This method was applied by Mr. E. G. William to the bright "new star" discovered by Mr. Prentice in Hercules in 1934; he found the distance to be 1200 light-years, which made the maximum luminosity of the star 30,000 times that of the Sun.

The Galaxy. Having applied the above methods to find the distances of stars, we can next discuss the size and shape of the huge system of stars to which the Sun belongs. The old Greek observers gave the name Galaxy, or Milky Way, to the girdle of pale milky light which can be plainly seen when the Moon is absent. It was suspected even in old times, and was confirmed by Sir William Herschel, that the light arises from multitudes of distant stars; the eye cannot see the separate stars, but can detect their combined light.

Herschel concluded, and later work has confirmed, that the star-system has a flattened shape, somewhat resembling a bun, the Galaxy marking the plane of its greatest extension. The diameter of the system is estimated to be about 90,000 light-years, its centre lying in the brightest region of the Galaxy, in Sagittarius. The Sun is supposed to be about two-thirds of the way from centre to edge. It is only in recent years that proof has been obtained that the whole star system is rotating round its centre. The

speed of the Sun in this rotation is estimated at 170 miles per second, giving 224 million years as the period of rotation. The reason of the tardy detection of the rotation is that all the nearer stars have almost the same rotational speed as the Sun; it was through study of distant stars (largely by Prof. J. H. Plaskett) that proof of the rotation was found. The flattened shape of the system is a result of rotation, the greatest thickness being about a sixth of the breadth. The thickness rapidly diminishes on moving outward from the centre. It is estimated that a mass of about 165,000 million suns is needed to control the rotation, but that half this mass may not be concentrated in stars, but exist in the form of diffused gas and dust.

Density of Stars. When iron is heated, its colour changes through red, orange, yellow to white heat; if still further heated it has a bluish tinge. We find the same sequence of colour in the stars, indicating difference in their temperatures. It is found that the stars may be divided into Giants and Dwarfs, the former are immense globes of low density, the latter are much smaller and have their matter much more tightly packed; the successive spectral types are denoted by different letters, red stars are of spectral type M, orange ones type K, yellow ones type G, yellowish-white type F, white type A, bluish white types B and O; it is supposed that the stars begin their career as red giants, then gradually become smaller and hotter, passing through the M, K, G, F, A, types, and if they are very massive also the B and O types. As their change of colour indicates, their temperature increases during these changes, but their surface diminishes, so that their output of light remains nearly the same, after their maximum temperature has been attained they pass into the dwarf class, becoming both smaller and cooler, so that they traverse the spectral types in the reverse order, ending in type M, but now as small, tightly packed bodies.

Betelgeuse is a typical M giant; its diameter was measured with the interferometer at Mt. Wilson, and found to be about 300 times that of the Sun; but its mass is probably not more than 25 times the Sun's, its density is therefore so low that it has been fittingly styled a "red-hot vacuum." Arcturus is a K giant, distant about 41 light-years; it exceeds the Sun a hundred times in light, twelve times in diameter. Capella is a G giant; exceeding the Sun 150 times in light, 12 times in diameter. The great southern star Canopus is an F giant, exceeding the Sun about 80,000 times in light, 200 times in diameter. Vega is an A giant, with 50 times the Sun's luminosity.

Beta Centauri is a B giant, with 3000 times the Sun's luminosity.

The best example of type O, the hottest of all the types, is known as the Plaskett star; it is just visible to the naked eye in Monoceros, but Prof. J. H. Plaskett found that it is distant about 9300 light-years, and that it consists of two stars, each having about 100 times the Sun's mass, and 14,000 times its luminosity. The diameter of each is estimated as 15 million miles; they go round each other in a fortnight.

It is thought that types B and O are probably reached only by stars of exceptional mass, and that other stars enter the dwarf stage after attaining types A or F. Procyon, the lesser Dog-star, is an F dwarf, with 5 times the Sun's luminosity, and 11 times its mass. The Sun may be taken as an example of a G dwarf. For K dwarfs we may take the two components of the double star 61 Cygni; the brighter star has about one-eighteenth of the Sun's luminosity. As an extreme M dwarf we take Proxima Centauri, the nearest known star, which gives only one ten-thousandth of the light that the Sun would give at its distance. This dimness is due partly to low temperature, but mainly to tighter packing of its materials.

In recent years another type of extreme dwarfs has been found; these are very dense white dwarfs. The earliest found was the faint companion of Sirius. This has half the mass of the bright star, but only one ten-thousandth of its light. But its spectrum shows the brilliant surface of type F, it thus appears that its diameter is one-thirteenth of the Sun's, yet their masses are about the same, it follows that its density is about 50,000 times that of water, so that a cubic inch would weigh nearly a ton.

Still more startling conclusions have lately been reached about a star of the thirteenth magnitude near Upsilon Draconis; its distance is fifty light-years, at that distance the sun would be a sixth-magnitude star; the star's luminosity is only one four-hundredth of the Sun's; yet it has the intensely brilliant surface of type B. It is deduced to be more than twice as massive as the Sun, but to be one quarter of the size of the Earth. Its matter is so tightly packed that a cubic inch at its surface would weigh 600 tons.

Novae. Mention has been made of "new stars"; the term is applied to the sudden brightening of a faint star to thousands of times its former lustre, after which it slowly dies down, but does not return exactly to its former state. It is thought to be caused by the star having reached an unstable condition, as a result of which its outer envelopes are violently expelled, to form an expanding

nebula; the core that remains is supposed to attain stability in a highly compressed condition; the white dwarfs just mentioned may result from these catastrophes. It is estimated that there may be an average of thirty new stars per annum in our star system, though most of them are too distant for naked-eye visibility; therefore quite a large proportion of the stars undergo such an outbreak in the course of their very long career as suns.

Star Magnitudes. The system is 2000 years old, having been introduced by Hipparchus and Ptolemy. They assigned the first magnitude to the brightest stars, and the sixth magnitude to the faintest that they could see; the system is now more precise, and has been extended in both directions; a drop of five magnitudes means a hundred-fold diminution in the light. Aldebaran is of magnitude 1; Vega of magnitude zero, the two brightest stars, Sirius and Canopus, have negative magnitudes. With the great 100-in. reflector at Mt. Wilson stars of the twenty-first magnitude have been photographed with long exposures. In going from the first magnitude to the twenty-first the hundredfold drop is repeated four times, so that a hundred million of these faint stars give the same light as one of the first magnitude. By the inverse square law a tenfold increase in distance means a hundredfold diminution of light; if the distance of a first-magnitude star were increased ten-thousandfold it would appear of magnitude 21. To find the light-ratio for a difference of one magnitude we take the fifth root of 100, which is 2.512.

Star Clusters. There are certain appendages of our star-system, outside it, and yet not quite independent—many clusters of stars, each tightly packed into a globular form. The nearest of them happens to be in the Centaur, like the nearest star. It is visible to the naked eye; its distance is 18,000 light-years. Another, in Hercules, is visible with a small telescope. Their connection with the galactic system is proved by the fact that both systems have the same centre. There are many less condensed clusters within the Galaxy; in fact the Sun and all its nearer neighbours are concluded to form such a cluster. There are two large assemblages of stars and nebulae in the southern heavens, known as the Magellanic clouds. Their distances have been measured by the Cepheid method, and are respectively 86,000 and 95,000 light-years; they are thus only separated from us by a distance equal to the diameter of our own system, and are rather annexes of the Galaxy than entirely independent systems.

The nebulae, or hazy patches of light

scattered over the heavens, belong to two different classes. Many, like the Orion nebula, are vast accumulations of gas within our star-system. Others, which give a continuous spectrum, are now known to be external galaxies, comparable with our own in size. This was held by Sir William Herschel and his successors up to the middle of last century. Then came the spectroscopic demonstration that some nebulae are gaseous, and the idea of external universes was generally abandoned; it was revived early in this century, and finally demonstrated by Dr. Hubble's discovery of cepheid variables in the Andromeda Nebula; by their periods and magnitudes he deduced that its distance, and that of its neighbour in Triangula, are both about 870,000 light-years.

The Andromeda Nebula resembles the Galaxy in many ways, they are of comparable size, for faint outer extensions of the nebula have lately been detected, both are in rotation; the outbreak of new stars has been observed in the Nebula; one of special brightness appeared in 1885. The Nebula is a great spiral, seen obliquely, as was first revealed by the photographs of Dr. Isaac Roberts. The spiral form is common in the nebulae. It is quite likely that the true form of the Galaxy is a spiral, but that would only be discernible from a point outside its plane.

We may conclude that the distant nebulae are galaxies similar to our own, but possibly smaller on the average; the number of them within reach of the largest telescopes is estimated to run into millions. The distance of the most remote one yet photographed is judged to be about 230 million light-years. See ASTRONOMY.

STARBOARD, *star' b'd*. See SHIP

STARCH. A soft, white, glistening powder originating within the living cells of plants. It is especially abundant in wheat, rice, potatoes, and root foods such as arrowroot and sago. Starch is made up of hydrogen, carbon, and oxygen, and is therefore a carbohydrate. It is one of the most important foods known to man, and is an active producer of energy and heat in the body, through which it circulates in the form of grape sugar, a chemical change resulting from digestion. It is highly nutritious when taken in combination with other foods.

Starch-making is confined to those plants which contain a green colouring-matter called *chlorophyll*, and takes place only under the direct influence of sunlight, and when water and carbon dioxide are both present.

How Starch is Prepared for Use. Starches are divided into two general groups—those used for food and those used in laundering, in the finishing of certain textiles, and as a thickening material in calico printing.

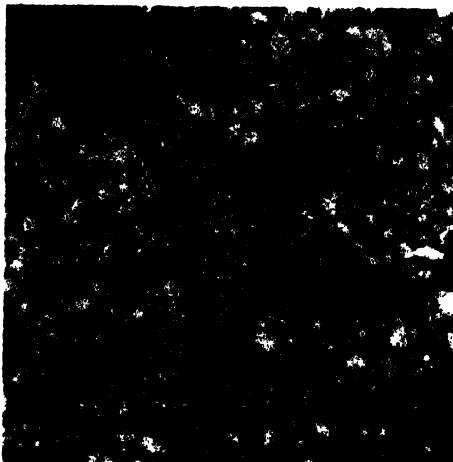
Starch is also used indirectly in the preparation of dextrin and starch sugar, potato starch being the principal variety employed.

Wheat, rice, and potatoes are extensively used in making starches for industrial purposes, rice starch being preferred for use in the laundry. Wheat starch is separated from the grain by two methods—fermentation and a mechanical process. In the former process, whole wheat or wheaten meal is soaked in water for the purpose of softening the wheat grains and causing them to swell. The grains are then reduced to a pulp, and a thick fluid is formed by mixing the pulp with water. The mixture is then placed in tanks and subjected to fermentation, after which the starch is separated in a washing drum.

By the mechanical process, a stiff paste is made by kneading wheaten flour. This is washed over a fine sieve, in the course of which the starch is separated from the gluten, the latter remaining in the sieve as an elastic, sticky mass. The starch is then purified and dried.

STAR CHAMBER. THE. This old English tribunal met at Westminster, and is said to have taken its name from a room where the meetings were held, which was decorated with gilt stars. It is supposed to have originated in the ancient exercise of judicial functions by the king's council. Until the fifteenth century, little is known of it, but in 1487 Henry VII reorganized it and gave it new powers, or, according to another theory, inaugurated a totally new court. His statute gave to a commission, composed of a chancellor, treasurer, keeper of the privy seal, chief justices, or, in their absence, two other justices, a bishop, and a temporal lord, the right to act as a court of trial for all misdemeanours of sheriffs or of jurors, and for all riots or unlawful assemblies. The

Without its aid, Elizabeth's life would probably have been short, for it could strike at political conspirators against whom the common law was powerless for lack of proof. It grew in unpopularity, however, partly



STAR-FISH, UNDER SURFACE
Photo. St. Clair

because of its custom of forcing prisoners by torture to confess. Under James I and Charles I, the hatred felt against the Star Chamber greatly increased, for through it were enforced the royal powers that the Parliamentary party claimed to be illegal. In 1641 it was abolished by the Long Parliament, along with its counterpart, the Council of the North. If it really owed its powers to the statute of 1537, it had certainly exceeded them; its authority seems, however, to have depended on the undefined powers of the Council, the jurisdiction of which had been challenged rather than limited by the rather vaguely worded statutes of 1363, 1364, and 1368.

STAR-FISH. One of a class of sea animals having the general appearance of a star or of a pentagon. The typical star-fish has five arms radiating from a flattened, central disc, but in some species there are many more projections, the number ranging from five to forty. Usually, the arms are not so sharply marked off from the disc as in the related class, the brittle stars. Star-fishes constitute the class *Asteroidea* in the major division, or phylum, *Echinodermata* (see *ECHINODERMS*) which includes brittle stars, sea urchins, sea lilies, and sea cucumbers, that is, all spiny-skinned sea creatures.

The skin of the star-fish is set with limy spines arising from skeletal plates developed



STAR-FISH
Photo: Visual Education Service

trials were without jury, and any sentences short of death might be passed.

During the time of the Tudors, this court, arbitrary as it was, was of real service in reducing to order the great nobles, who, when brought before any ordinary court, often succeeded in intimidating the jury.



STARLING

Photo E. J. Hocking



AFRICAN STARLING

Photo Cherry Kearton

just under the skin. On the under surface of the disc is a mouth, and on the same surface of each arm there is a groove beginning at the mouth and ending near the tip of the arm. From rows of tiny holes in these grooves the starfish can push out slender, glassy tubes, or "feet." These tubes exert a suction on surfaces and enable the animal to crawl. At the tip of each arm there is one small pigment spot, often called an eye, protected by a circle of spines. Starfish have remarkable powers of regeneration (which see).

Starfish are found in all parts of the world except the Polar regions. They have a well-developed digestive system, and subsist chiefly on oysters, mussels, clams, and snails. Nearly all of the central disc is occupied by

a bag-like stomach, into which the mouth opens. Folds of the stomach extend out into the arms. In the North Atlantic, the common starfish causes serious losses by preying on the oyster beds.

STARHENBERG, PRINCE ERNEST RUDIGER VON (born 1899). Prominent in Austria in recent years as a leading Minister (Vice-Chancellor) of the Republic; had been for long the head of the Fascist organization, with an unofficial but large body of

Kurt Schuschnigg, the movement against both Socialism and subservience to Germany, has been the feature of Austrian affairs in recent times. While for long it seemed that Dr. Schuschnigg and Prince Starhemberg were working in close co-operation, a rift appeared in 1930 and, by a dramatic *coup d'état* in the autumn of that year, Dr. Schuschnigg achieved supreme power, the Storm Troop body was dissolved, and Prince Starhemberg retired from the active political field.

STARLING. A well-known bird, common all over Britain and in most parts of North-west Europe. The starling is about the size of a thrush, dark in colour and with a metallic sheen. The new coat in autumn has a speckled appearance, but these marks get worn off by springtime. The African glassy starlings carry the peculiar metallic coloration to a much greater extreme.

Starlings are very cosmopolitan in their nesting habits, but generally nests are made in holes in trees and in rock crannies. Food consists mainly of insects, worms, etc., but they are fond of grain and fruits.

In Britain, starlings have increased considerably in number during the last half century. In the autumn they congregate in large flocks, particularly in south and south-west England.

Scientific Name. Starlings are of the family *Sturnidae*. The common starling is *Sturnus vulgaris*.

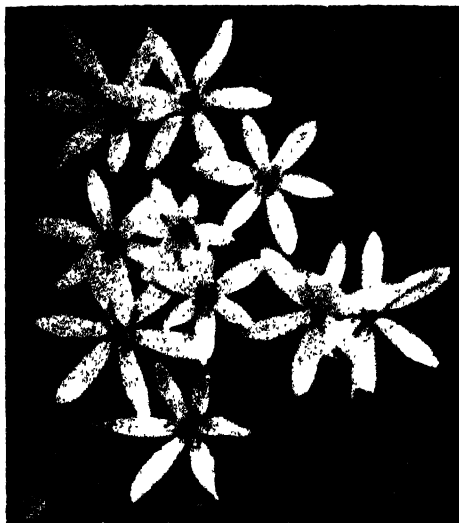
STAR OF BETHLEHEM. There are three varieties of this bulbous-rooted plant of the lily family, of which the native variety is the Spiked Star of Bethlehem. The stem is thick and something over a foot high. The flowers, greenish yellow in colour, have six wide-spreading perianth lobes, and at the base of each flower stalk where it joins the stem is a bract. The flowers form a spike at the end of the stem. All the leaves grow from the bulb.



PRINCE STARHENBERG

Photo: Photopress

"Storm Troops," called the Heimwehr. His energy in developing, in co-operation with Dr.



STAR OF BETHLEHEM
From F. J. Hosking

The flowers of the common variety are white, with a green streak at the back of the perianth lobes. Those of the drooping variety are white. Flowering time is late spring or early summer.

Scientific Names. The Star of Bethlehem forms the genus *Ornithogalum* in the family *Liliaceae*. The spiked is *O. pyrenaicum*; the common, *O. umbellatum*; the drooping, *O. nutans*.

STATES-GENERAL. A legislative assembly in France which existed from 1302 until 1789. The term is also applied to the present Dutch Parliament. The States-General of France was composed of representatives of the clergy, the nobility, and the common people, who constituted what was known as the Third Estate. Until the States-General of 1484, the representatives of the clergy and the nobility were summoned personally by the king, while the representatives of the Third Estate were elected by the people they represented. After 1484, however, the representatives of all classes were elected by vote.

The States-General did not meet at regular intervals, but was called together by the king in times of emergency, whenever he needed advice or money or moral support. Direct power belonged exclusively to the king, but the influence and indirect power of the States-General were at times very great. By the year 1614, however, the power of this assembly had declined to almost nothing. When it was again summoned in 1789, the representatives of the Third Estate, who had been growing very powerful, made the famous decision, which led to the French

Revolution (which see), that the members of the States-General should constitute a National Assembly with full sovereign powers.

The States-General of the Netherlands, an assembly in which each province had one representative and one vote, was in existence at The Hague from 1593 until 1796, when it too became a National Assembly. The present Dutch Parliament, however, bears the name States-General (*Staten Generaal*).

STATES OF THE CHURCH. A name applied to the Papal States (which see).

STATICE, *stat' is se*. See SEA LAVENDER; PLUMBAGO.

STATICS. A branch of dynamics. Dynamics treats of the properties of matter and forces, and is divided into two branches—*statics* and *kinetics*. Statics deals with conditions under which there is no change of motion of material bodies when they are acted upon by various forces. When two or more forces so act upon a body as to produce no change of motion, they are said to be in *equilibrium*.

STATISTICS. Statistics may be defined as numerical facts, arranged and classified. A fuller definition is: "Numerical statements of facts in any department of inquiry, placed in relation to each other; statistical methods are devices for abbreviating and classifying the statements and making clear the relations" (Prof. Bowley). The science of statistics consists of these definite sections: the collection of data by *questionnaire* or by other means, the recording and classification of these facts, the application of the data to problems, and the formation of judgments and policies in the light of what has happened in the past. Statistics seem to have first been used in connection with the census of population, and the published returns of such data are examples of clear and concise presentation of figures in analytical form.

Sufficient information must be given if statistics are to be of any value. Percentages are not always a reliable guide; for example, the schoolboy who gets twenty sums correct out of twenty-five attempted (80 per cent) is possibly more accurate than one who gets two correct of the two attempted (100 per cent). Averages, too, may be misleading; for instance, a firm showing profits of £1000, £1500, and £2000 in three successive years (average £1500) may be considered more attractive to an investor than one of similar size showing profits of £2500, £1500, and £800 in the same three successive years (average £1600), as the former is increasing in prosperity while the latter is declining.

Statements of facts may relate to groups, classes or series. When a large number of persons or things of similar type, as employees in the same occupation, and houses in the

same locality, differ from one another in some characteristic which is capable of measurement, e.g. wages or rents, they constitute a statistical *group*. If the differing characteristics are not measurable, but require separate descriptions, e.g. the number of persons in different employments, there is a statistical *class*. If the numbers of a group or class are counted periodically, or the quantities or values ascertained weekly, monthly, annually, etc., there is a statistical *series*. Groups can be shown by means of diagrams or described briefly by averages. Classes can be indicated by means of statistical tables, and their sizes denoted by percentages. A series is more easily understood by the aid of a graph.

Graphical representation is used in business to show the relationship of production to cost, profit to turnover, expenses to income, income or turnover in successive periods, etc. Besides the usual graph there are many other kinds of diagrammatic forms of presenting statistics. For purposes of comparison, areas are sometimes used in diagrams and a circle (or "pie" graph) indicates a total (sales, expenses, etc.), being divided into segments in the proportion that each item making up the total bears to that total. Bar diagrams are also used to illustrate items which are made up of two or three components, the bars or oblongs being divided into black, white, and shaded portions, or into colours. A *pictogram* is a diagram used when it is intended to have a popular appeal. An instance would be ships of various sizes to show the comparative size of the world's navies.

Statistics are the basis of budgetary control in industry. Some firms have such efficient statistical and finance departments that they are enabled to present, with their annual balance sheets, the likely figures for the *following* year, and these forecasts usually are remarkably accurate.

This application of statistical methods involves an entirely new aspect of the values of statistics. Budgetary control consists in compiling a forecast of all figures for the ensuing year (sales, purchases, wages, cost of production, etc.), based on available statistics of past figures and the technical knowledge available. The whole direction of the policy of the business is thus formulated on a preconceived balance sheet.

STATOR, *stay' tōr*. See DYNAMO.

STATUTE. An enactment of an authorized law-making body. *Statute law* is another term for *written law*, and is to be distinguished from *unwritten* or *common law*. The bodies by which statute law is enacted are known variously as Congress, Parliament, Assembly, Legislature, etc. In the United Kingdom

the supreme legislature or statute-making body is the King in Parliament, that is, the body composed of the King, the House of Lords and the House of Commons. The authority of an Act of Parliament cannot be questioned in any court. See COMMON LAW; PARLIAMENT.

STAVANGER, *stah' vang' er*. See NORWAY.

STEAD, WILLIAM THOMAS (1849-1912). English journalist, born at Embleton, Northumberland. He became editor of the *Pall Mall Gazette* in London in 1883, and he began a campaign for laws to protect women and children from outrages.

In 1890 he founded the *English Review of Reviews*, in 1891 the *American Review of Reviews*, and in 1894 the *Australasian Review of Reviews*.

STEALING. See LARCENY.

STEAM. Steam is the vapour of water. Imagine a cylindrical closed vessel which has been completely exhausted of air. If a quantity of water is introduced into the vessel, part of it will quickly evaporate into vapour or steam and will fill the space above the water which remains at the bottom of the vessel. Such steam, which is in contact with a water surface, but which does not contain any water particles in suspension, is said to be *dry and saturated steam*. The vapour or steam will exert a certain pressure on the walls of the containing vessel. This is termed the *steam pressure* and depends only on the temperature of the water and steam. Thus at 60° F., the pressure is only a quarter of a pound weight on the square inch; at 212° F., it is equal to the pressure of the atmosphere, i.e. 14.7 lb. per sq. in., and at 400° F. it is 250 lb. per sq. in.

When water is heated in open vessels subjected to the atmospheric pressure, little steam is formed until the temperature of the water has been raised to 212° F., at which temperature, as stated above, the vapour pressure is just equal to the pressure of the atmosphere. The heat supplied to raise the temperature of the water to the boiling point is called *sensible heat* because it causes a change in the state of the water which can be detected by feeling. As soon as the water temperature reaches 212° F., however, the further addition of heat does not cause a rise in temperature but is utilized in vaporizing the water. Bubbles of steam are formed at the heated surface and break through the water surface. This process is termed *boiling* or *ebullition*. If the steam, as it escapes through the water surface, carries away with it a small amount of water in suspension, it is said to be *wet steam*.

Mist seen near the spout of a kettle is not steam, but is a cloud of very small

water drops formed by the sudden cooling of the steam. Steam is invisible.

Steam which is not in contact with water may be heated to very high temperatures without any change of pressure. Such steam is said to be *superheated*.

STEAM ENGINE. The steam engine is a device for converting a part of the heat energy which is latent in natural fuels into mechanical energy. The fuel—coal, wood, gas or oil, as the case may be—is burned in the furnace of the *boiler* and the heat so generated is utilized to convert water into steam, at a certain definite pressure, termed the working pressure. In the *piston engine*, the steam previously generated in the boiler exerts a considerable force on the piston due to its pressure. The piston is merely a circular disc which slides back and forward in a cylinder and is attached to a rod known as the *piston rod*. The other end of the piston rod is guided so that it moves in a straight line and is suitably attached to a *connecting rod* which transmits the force in the piston rod to an arm or crank on the engine shaft. A sliding valve or system of valves causes steam to be admitted first to one side of the piston and then to the other. The same valve or system of valves allows the steam to escape from alternate ends of the cylinder after it has expanded to a lower pressure, termed the exhaust pressure, and done its work on the piston. The reciprocating motion of the piston rod is changed into a rotary motion by the crank.

When the steam has done its work in the cylinder it may be allowed to escape into the atmosphere. Such an engine is called a *non-condensing engine*, because the steam is not condensed in the engine system. This,

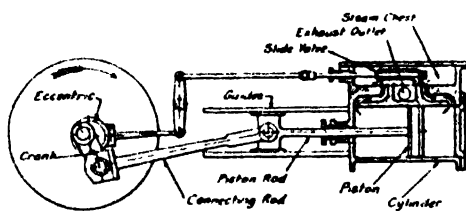


FIG. 1. DIAGRAM OF STEAM ENGINE

however, is a wasteful procedure, and in most engines the exhaust steam is re-converted into water in a separate chamber termed a *condenser*. The condensed steam in the form of warm water is then pumped back into the boiler, where the cycle of operations begins anew.

An engine which exhausts into a condenser is much more economical than one which exhausts into the atmosphere, because by using a condenser, the pressure of the

exhaust steam may be lowered to a value well below the pressure of the atmosphere, thus leading to a greater force on the engine piston.

Although the expansive properties of steam were known to the ancients, it was not until the eighteenth century that the steam engine took practical shape. Thomas New-

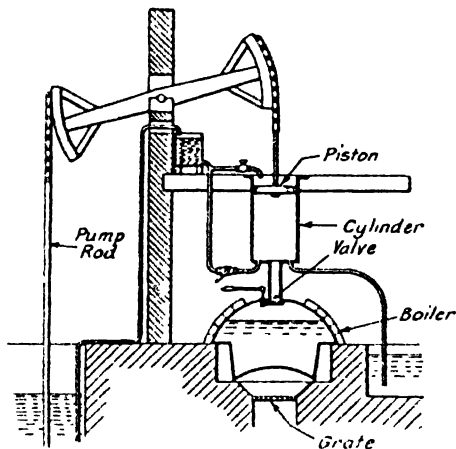


FIG. 2. DIAGRAM OF "ATMOSPHERIC" ENGINE

comen, in 1712, invented a piston engine called an "atmospheric engine." The Newcomen engine was widely used for pumping water out of mines. It had a cylinder (see Fig. 2) which was placed directly above the boiler. The piston rod hung from one end of a rocking beam and the pump rods from the other. Strangely enough, the steam did not produce any work on the piston due to its pressure. When the piston was at the bottom of the cylinder and the steam valve was opened, the piston was lifted to the top of the cylinder by the weight of the pump rods. The cylinder was now full of steam and the steam valve was closed. Water was allowed to flow into the cylinder and on top of the piston; the steam in the cylinder was rapidly condensed, and owing to the partial vacuum formed beneath the piston, the pressure of the atmosphere forced the piston downwards and lifted the pump rods. Hence the name "atmospheric engine."

James Watt in 1763-64, while engaged in the repair of a working model of a Newcomen engine, saw that the alternate heating and cooling of the cylinder required large quantities of otherwise unnecessary heat. So he devised an engine in which the condenser and cylinder were separate. The cylinder was thus kept hot while the condenser was cold. As a result the fuel consumption of the engine was at once halved.

Watt made many other improvements in steam engines. One of the most important was to shut off the supply of steam to the cylinder when the latter was only partly filled and to allow the steam to expand to a lower pressure during the completion of the piston stroke. He later invented the rotative engine and also the double-acting engine, in which the steam was used on both sides of the piston alternately.

Steam pressures were very low in Watt's day, being but a few pounds per square inch.

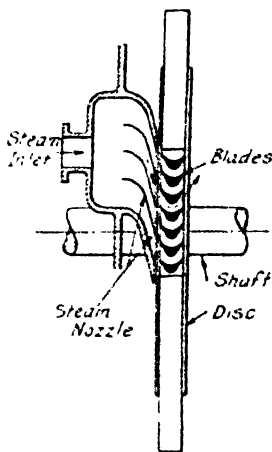


FIG. 3. STEAM TURBINE

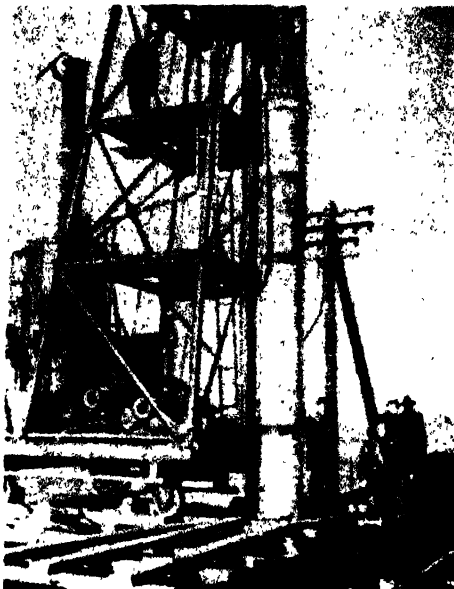
As more experience was gained in the construction and operation of steam engines and boilers, pressures were gradually raised. The use of higher steam pressures, however, led to a greater range of temperature in the cylinder, and to reduce the losses which were caused by this, the total expansion of the steam was divided into two, three or even four stages. This type of engine was known as a *compound*, *triple-expansion* or *quadruple-expansion engine* respectively, according as the steam expanded in two, three or four cylinders in series.

Towards the end of the nineteenth century, the practical development of the *steam turbine engine* was undertaken by Parsons, de Laval, Rateau, Zoelly, and some others. The expansion of the steam in most turbines is divided into many stages, and in each stage there are a number of *nozzles* (see Fig 3) from which the steam issues at a very high velocity. Directly opposite the nozzles is a complete ring of *blades* which are attached to the rim of a wheel on the turbine axle. The steam jets are deflected by these curved blades and thus the steam exerts a considerable force on the periphery of the wheel and drives it round at a high speed.

The turbine is used almost exclusively in electric generating stations and is very widely used for the propulsion of large ships.

STEAM HAMMER. The steam hammer was invented by James Nasmyth in 1839, and revolutionized all industries in which heavy forging was necessary. The Nasmyth hammer was raised by steam admitted into

a cylinder beneath it. When the hammer was raised to the required height, the steam was allowed to escape and the hammerhead fell by force of gravity. The head might weigh 100 lb., or as much as 100 tons. In the modern steam hammer, which is based on



STEAM HAMMER

The world's largest concrete tube pile being driven to form a foundation for a Southern Railway main line bridge near Whitstable

Photo 101

the first machines, steam is admitted alternately above and below the hammerhead, the pressure of the steam from above adding to the force of the downward stroke.

STEAMSHIP. See SHIP

STEAM SHOVEL. A large scoop fitted to a beam that can be moved in any direction, operated by steam power, and used in excavation work. The scoop's capacity varies between $\frac{1}{2}$ cub. yd. and 12 cub. yd. It is lowered to the ground and driven forward and upward with a powerful sweep, and so gathers earth and rocks which are transferred to trucks for removal from the site.

STEARIN, sté'a rin. A combination of stearic acid and glycerine, it is the chief ingredient in mutton suet, beef tallow, and certain vegetable fats, such as palm oil. When crystallized, stearin forms pearly, waxlike scales, having neither taste nor odour, soft to the touch, and not greasy. It cannot be dissolved in water, but is soluble in ether and hot alcohol. When treated with superheated steam, it is resolved into its

component parts—glycerine and stearic acid. When stearin is boiled with alkali, the stearic acid combines with the alkali to form soap, and the glycerine is separated. Stearin is prepared commercially from beef suet, cotton-seed oil, and from other fats. It is a complex compound of carbon, hydrogen, and oxygen.

STEATITE, *stē' a tīl*. A soft rock, composed chiefly of talc. It has a soapy or greasy feel, and ranges in colour from light grey to almost black. Steatite is easily sawn into slabs, and because of its peculiar oily feel, it is often called *soapsstone*. The so-called *French chalk* is made of pulverized steatite. Steatite is also used as a filler in the manufacture of paper, as well as in the manufacture of "lava" tips for gas burners, for electrical insulation, as a filler for paint and rubber goods, and as a lubricant. See TALC.

STEEL. See IRON AND STEEL.

STEELE, SIR RICHARD (1672-1729) English essayist and dramatist of the early eighteenth century. He was born in Dublin and was educated at Charterhouse School



STEELE

Photo Brown Bros

and at Oxford. Steele had a very varied career. He served in the army, rising to the rank of captain, held various political offices, sat in Parliament, and found time to write witty plays, compose mediocre poetry, and establish periodicals.

The essay, of course, had existed as a literary form long before the days of Steele; his great

innovation was to publish it periodically, and to use it as a commentary on contemporary life. The *Tatler*, which he started in 1709, came out three times a week, the *Spectator*, begun in 1711 after the *Tatler* had ceased to exist, appeared daily. Steele afterwards started the less successful *Guardian*, and it was followed by other periodicals. He was inferior to Addison as a stylist, but he was perhaps the more original of the two men, starting many of the ideas—such as the famous Sir Roger de Coverley—which were afterwards developed by Addison. Of his four comedies, the best are *The Funeral* (1702) and *The Conscious Lovers* (1722).

STEEPLECHASE. A form of horse racing carried on from November to March in

Britain, mainly during the close season for flat racing. An essential of the steeplechase is that the course must either be across country from point to point and including all natural obstacles, or must be over a prepared course in which a number of artificial obstacles have been introduced. Regulations as to the number and nature of these obstacles have been laid down by the National Hunt Committee, the body governing the conduct of the sport. Fences, ditches



ROYAL ARTILLERY POINT-TO-POINT STEEPLECHASE

Photo Photopress

and water jumps must be included, whilst the number of fences must reach an average minimum of six in each mile of the course. The most famous and the most difficult course in England is that at Aintree near Liverpool, where the premier race of the steeplechase season, the Grand National, is decided annually in March. This race, over 4½ miles and including thirty jumps, was instituted in 1839 and has since then attracted an ever-increasing field.

The origin of the term "steeplechase" must be sought in the earliest type of cross-country riding, when a distant church steeple was made the goal of the race, and the riders were required to ride directly to it from a given point.

STEFANSSON, *stēf' an sōn*, VILHJALMUR (born 1879). Discoverer of new land in the Arctic Ocean; he was born in Manitoba of Icelandic parents, and educated in the United States. He made several trips to the far north before the Canadian government sent him to explore the northern shores of Canada and Alaska. In 1913 his boat, the *Karlak*, was caught in the ice and sank, with a loss of eleven lives; but Stefansson, who was with another part of the expedition, resumed the journey by sledge. With two men and six dogs, he crossed Beaufort Sea on moving ice to Banks Island. In the following years he made many discoveries in the North-West of the Canadian Arctic Archipelago.

STEINBOK, *stīn' bok*, OR **STEENBOK**. A very small antelope found in the southern part of Africa. Its Dutch name, which

means "stone-buck," was given because it is usually found in rocky places. The steinbok is about 24 in. tall, and has a reddish-brown coat that is white underneath. The male has two forward-curving ringed horns about 4 in. long. See ANTELOPE; IBEX.

Scientific Name. The steinbok belongs to the family *Bovidae*. Its scientific name is *Nanotragus campestris*.

STELLITE, stel' ite. See ALLOY.

STEM. The stalk of a plant, shrub, or tree. It is a co-worker with the leaves in changing into plant food the raw materials obtained from the soil. The water and dissolved salts taken in by the roots are carried to the leaves by the stem.

Structure and Growth. Liquid food passes upward into the leaf by certain tissues, or bundles of long, narrow, tubular cells. The actual path is through the xylem, or woody part of the *fibro-vascular bundles*, whose name means "collections of threadlike, woody tubes." Those plants in which the bundles of cells are distributed irregularly throughout the stem are the *monocotyledons*. The group in which the bundles are arranged radially around the pith, as in our common trees, are in general the *dicotyledons*.

The stems of the latter plants consist of an outer protective covering of bark and woody layers extending to the pith. The cells are of several kinds. In the bark there may be cork layers, preventing loss of water; flexible, tough, fibrous cells giving strength to the stem; sieve tubes carrying the plant food from the leaves; and woody cells forming the channel through which the water passes to the leaves from the root. Between bark and wood is a layer of growing tissue, the *cambium*, whose function it is to form new bark on the outer side, and new wood on the inner side. The lifetime of a tree is reckoned from the number of rings or layers of new wood formed by these growing cells.

In some plants, the stems live but a year, in others two years, and in still others, indefinitely.

Underground Stems. The long, slender root-stocks of several plants such as mint, the short, thick bulbs of the hyacinth and lily, and the familiar tuber of the potato are underground stems. They contain large quantities of reserve food, and supply the plant when new food cannot be made.

Reproduction by Stems. Many plants are reproduced by portions of the stem. Our most obnoxious weeds are those which have underground stems or rootstocks which, though cut by the hoe, produce a new plant at every node. The slender runners of the strawberry, the bulbs of the lily, and tubers of the potato also produce new plants.

Many plants are reproduced from cuttings, or broken-off stems, which take root when planted.

STENCIL, sten' sil. A thin sheet of metal or other material with a pattern cut out by means of interrupted lines or dots. It is used in reproducing letters and designs. The stencil is placed on the surface or material to be ornamented, and a brush or sponge wet with ink or paint is passed over it. Packing boxes are often marked with stencils, and the process is employed extensively in embellishing curtains, bed covers, garments, and other household articles. Furniture also lends itself to stenciling.

STENOGRAPHY. See SHORTHAND.

STEPHEN. The first Christian martyr. He was stoned to death after the Ascension of Christ. One of the seven deacons appointed by the Apostles to minister to the poor, Stephen was a man of great piety and performed miracles. He was accused by the Jews of blasphemy and brought to trial before the Sanhedrin. Stephen defended himself with a masterly speech (Acts vii), which so infuriated his hearers that they dragged him outside the city and stoned him there.

26th December is celebrated as Saint Stephen's Day.

STEPHEN (1097-1154), KING OF ENGLAND. The son of Stephen, Count of Blois, and Adela, daughter of William the Conqueror; he was married to Matilda of Boulogne. He with his fellow barons had sworn an oath of allegiance to Matilda (or Maud), the daughter of Henry I and widow of the Emperor, promising to secure her succession to the throne. But the marriage of Matilda to Geoffrey of Anjou was highly unpopular with the barons. Moreover English history showed no precedent for the accession of a woman. Stephen; too, won popularity by lavish grants and promises to the barons, to the towns and to the Church. Accordingly the Great Council broke faith with the Empress and elected Stephen king, with the approval of the citizens of London and Winchester.

Barons' Wars. The first seventeen years of the reign were occupied with a war of succession, perhaps better described as a confused scramble for mastery. Stephen and Matilda raised rival armies by competition in bribery, and the former introduced foreign mercenaries. Many of the barons established independent earldoms in which the king's writ did not run. Hundreds of "adulterine" castles (that is, castles built without royal licence) were erected. One of the latest entries in the Anglo-Saxon Chronicle bewails the reign of terror: "They cruelly oppressed the unhappy people by putting them to

forced labour on castle-works, and when the castles were finished they filled them with devils and evil men. . . . I neither can nor will tell all the wounds and all the tortures which they inflicted on the wretched men in this land . . . they said that Christ and His saints slept." The country was given over to anarchy, and neither Stephen nor Matilda was strong enough to control the forces they

she was besieged by Stephen but escaped to Wallingford over the snow. Stephen had been exchanged for Matilda's half-brother, Robert of Gloucester.

During the years 1142-1147 the West was for Matilda while London and the East supported Stephen. There was a cessation of fighting after 1148, when Matilda returned to Normandy, though the country was still without government.

Stephen was anxious to secure the succession of England for his son Eustace, while Geoffrey of Anjou and Matilda centred their hopes in their son Henry. In 1151 Geoffrey



KING STEPHEN

Reproduction from an old print.

Photo: Newton

had let loose. In the north country, David of Scotland was bought off by the cession of Carlisle and part of Strathclyde, and the grant of the earldom of Northumberland to his son. Geoffrey of Anjou overran Normandy and the duchy was granted to him by the king of France. In 1138 David was defeated near Northallerton at the Battle of the Standard.

In February, 1141, Stephen was taken prisoner at Lincoln and Matilda was elected "Lady of England" in a Council of Clergy at Winchester. But she proved herself as unfit to govern as Stephen. By her overbearing arrogance she alienated the citizens of London, was driven out again, and ultimately found refuge in Oxford. Here



GREAT SEAL OF STEPHEN (1135)

Photo: Newton

died, and the Angevin claim descended upon his heir. By his marriage to Eleanor of Aquitaine, Henry added Poitou and Aquitaine to his dominions and was now lord of half the territories in France. In 1153 he landed in England. Negotiations followed, which were made easier by the untimely death of Eustace. The Treaty of Wallingford was drawn up whereby Stephen was recognized as king while he lived, but was to be succeeded by Henry of Anjou, first of the Plantagenet line. It was agreed further that the mercenary armies were to be disbanded and the unlicensed castles dismantled. In the following year Stephen died.

STEPHENSON. The family name of two British engineers, father and son.

George Stephenson (1781-1848) was born at Wylam, near Newcastle. After working on a farm, he assisted his father as fireman in a colliery. He worked out the idea of applying steam power to locomotive engines, and set one at work in 1814 to

operate on a colliery tramway. An improved engine was completed the following year.

Stephenson was appointed chief engineer of the Stockton and Darlington Railway in



GEORGE STEPHENSON
Photo: Brown Bros.

1821. Three years later, he became engineer of the Liverpool and Manchester Railway, which purchased his famous locomotive, the "Rocket." See RAILWAYS.

Robert Stephenson (1803-1859), the son of George Stephenson, was born at Willington Quay. In 1824 he went to South America to take charge of mining

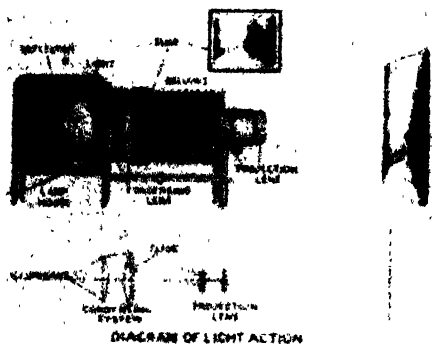
operations, and on his return helped in the building of the "Rocket." He afterwards became chief engineer on the construction of the first railway to enter London, known then as the London and Birmingham Railway.

Robert Stephenson was, however, chiefly noted for the engineering genius shown in the great bridges and viaducts constructed by him. He invented the tubular bridge, and also introduced the use of tubular girders in the construction of iron bridges. Especially notable achievements are the high-level bridge at Newcastle, the famous Britannia tubular bridge over Menai Strait, and the Victoria Bridge across the St. Lawrence River at Montreal.

STEPPE, *steps*. The Russian name for the extensive, treeless lands extending from South-eastern Europe along the borders of the Caspian Sea to the Altai Mountains in Central Asia. As there is little moisture, farming without irrigation is impossible, although, just north-west of this region, lies the vast "black-earth" plain, the best agricultural land of the Soviet republic. During the spring, when the rains start the grass growing, great herds of cattle, sheep, and horses may be seen grazing, but the summer droughts dry up the lands.

STEREOPTICON, *ster re op' tik on* or **MAGIC LANTERN**. An apparatus for projecting on a white surface a magnified image of a picture. The principal parts of the apparatus are the lantern, or box for enclosing the light, the condenser, the objective, and the light. The lantern has openings at the top and bottom to provide thorough ventilation. A door on the side next to the operator gives ready access to the light. The condenser consists of a large, double-convex lens (see **LENS**), or, more frequently, of two

plano-convex lenses with their curved surfaces facing each other. The purpose of the condenser is to gather the rays of light and throw them upon the picture to be



MECHANISM OF THE STEREOPTICON

projected. The objective consists of two double-convex lenses, mounted in a tube of the right length to enable each lens to aid in magnifying the picture. This tube is mounted in a frame with a rack and pinion, permitting focus adjustment to get a sharp definition of the picture on the screen.

Various devices are used for illuminating magic lantern pictures. Lanterns which use an incandescent light can be operated by connecting with an ordinary electric light attachment. Acetylene gas and the oxy-hydrogen limelight are also in use.

The pictures generally used in magic lanterns are photographs on glass, and are known as slides, the English slide is $3\frac{1}{2}$ in square. They may or may not be coloured. Because the lens inverts the picture, the slide must be inverted in the lantern to have the picture appear correctly upon the screen.

STEREOTYPE. A printing plate cast from a mould or matrix taken from movable type. It is a duplicate of the original type or engraving, but is naturally somewhat coarser. A matrix made of a specially prepared paper or plaster is pressed by rollers on to the original, and a good impression or negative is secured. The "positive" is secured by pouring over this stereotype metal which, when cooled, is mounted ready for printing.

STERLING. In finance, this word is used to denote British money as distinct from the money of other nations, particularly the gold coinage. The word seems to have been derived from the old German merchant bankers known as Easterlings or Esterlings, and has been applied to English cash from early times, usually denoting a particular coin. When the silver penny was the

monetary unit, it was called a sterling. In course of time the word came to be used to denote any of the accepted money of the kingdom, but later it attached itself to the gold coinage, quotations being made in "pounds sterling," that is, coins of the nature and character prescribed by law. Since Britain went off gold in 1931, sterling has been adopted as the basis of their coinage by more than twenty nations, who now work in close financial co-operation with Britain. See MONEY.

STERNE, LAURENCE (1713-1768). An English author who had a distinct part in the development of the novel as a form of literature. He was born at Clonmel, Ireland. In 1736 he graduated from Cambridge, and two years later was ordained and given a living in Yorkshire, where he spent twenty years. With the publication of the first two volumes of *Tristram Shandy* in 1759, his seclusion ended, for at once the book became very popular, and the author was much in demand in London society. Seven other volumes of the work appeared within the next eight years, and Sterne's renown increased. Travels on the Continent in 1765 resulted in *A Sentimental Journey through France and Italy*, which became the book of the moment in England, France, and Germany. Sterne lived but a month after the publication, in 1768, of what were to have been only the first two volumes.

STETHOSCOPE. An instrument used by physicians in examining the heart and lungs. Variations in the sounds heard in these organs indicate certain diseases. It was in-



STEVENSON'S HOME ON UPOLU, IN SAMOA
Photo: U. & U.

roduced by Laënnec in 1819. It commonly consists of two earpieces connected by rubber tubes to a bell-shaped wooden chest-piece, sometimes fitted with a device for amplifying the sounds.

STETTIN. See GERMANY.

STEVENSON, ROBERT LOUIS [properly, ROBERT LEWIS BALFOUR] (1850-1894). A Scottish essayist, poet, and writer of fiction, born in Edinburgh. His father was a civil engineer, and the son showed much interest in that profession, which he was not robust enough to adopt. He studied at the University of Edinburgh, though his work was constantly interrupted by ill-health, received a training in law, and was called to the Bar at Edinburgh in 1875. However, he turned from law to literature, and in 1878 published *An Inland Voyage*, in which is described a canoeing journey in France and Belgium. Critics recognized at once the charm of the young writer's style, but the public gave the graceful sketch little attention. In the following year, he published *Travels with a Donkey*, the material for which had been furnished by a trip through Southern France.



R. L. STEVENSON
Photo: Brown Bros.

In 1879 Stevenson married Mrs. Osbourne at San Francisco, and, after some months spent in a desolate mining camp, returned with her and her son Lloyd to Scotland. His health, always far from robust, had suffered severely from the strain of his journey (he had travelled "steerage" to America), and the years following his marriage were wandering ones, spent in search of a suitable climate. In 1888, still in quest of health, he went with his family to Samoa, in the South Seas, where he settled down, and made his home at the foot of Mount Vaea.

He acquired great influence with the natives, and took an active interest in their politics. After his death, sixty natives carried his body to the grave on Mount Vaea.

In spite of poor health, Stevenson produced between 1886 and 1888 two collections of delightful essays, *Virginibus Puerisque* and *Familiar Studies of Men and Books*; a volume of fanciful and entertaining stories, the *New Arabian Nights*; the very popular *Treasure Island*; *Prince Otto*, a pleasing romance; *Dr. Jekyll and Mr. Hyde*; *Kidnapped*, an

excellent and widely read story of Scottish life; and two collections of poems, *Underwoods* and *A Child's Garden of Verses*, the latter of which reveals a remarkably sympathetic understanding of child life. The most notable of his productions during the Samoan period were *The Master of Ballantrae*, another story of Scottish life; *Catriona*, a sequel to *Kidnapped*; and the uncompleted romances *St. Ives* and *Weir of Hermiston*, this latter regarded by many critics as Stevenson's greatest work.

His intimate letters, collected in several volumes, are remarkable for their vividness and humour, and show us besides how their



STICK-INSECTS FROM JAVA

Photo: Cherry Ku

author faced the handicaps of ill-health with unflagging spirit and determination.

STEWART OR STUART, FAMILY OF. Alan, son of Flaald, was granted the Castle of Oswestry by William I. From his eldest son William descended the Fitzalans of Arundel, ancestors of the ducal house of Norfolk. His second son Walter (died 1177) vigorously championed the Empress Matilda, Lady of England, and was granted lands by her uncle, David I, King of Scotland, who created him Hereditary Lord High Steward. His son Alan joined the Third Crusade. His son, another Walter, was Justiciar of Scotland; by his time Steward or Stewart had become a surname. Alexander, fourth High Steward, was Regent for Alexander III, and defeated the Norwegians at Largs in 1236; from his younger son John descended the Stewarts of Angus, Lennox, Darnley, and Atholl. James, his successor, shared in the regency after the death of Alexander III, and aided Wallace.

Walter, sixth High Steward, fought at Bannockburn, held Berwick in 1319, and married Marjory, daughter and heiress of Robert Bruce. Robert, their son, was Regent from 1338 to 1341 and, on the death in 1371 of his uncle, David II, succeeded to the throne as Robert II. He and the rest of his dynasty are dealt with in individual articles. The marriage of Mary, daughter and heiress of James V, to a Dauphin of France caused her to adopt the Gallicized spelling of "Stuart." Her son, James VI, succeeded to the throne of England in 1603. His grandson James II fled abroad in 1688. On the death of the second son of the "Old Pretender," the Stuart claim passed to the house of Savoy, as being descended from Henrietta, Duchess of Orleans, the sister of Charles II. Their descendants, the Bavarian Royal House of Wittelsbach, have never advanced their claim.

STIBNITE. See ANTIMONY.

STICK-INSECT. A name given to certain orthopterous insects from their resemblance to twigs on the trees where they feed. There are several species; and while some are found as far north as France, the largest are natives of the tropics. All stick-insects have powers of regeneration. Their colour, naturally, is usually in conformity with their surroundings, but certain species have wings which show beautiful colouring when spread.

Classification. Stick-insects belong to the family Phasmidae.

STICKLEBACK. The name familiarly applied to a family of small fishes of the northern hemisphere, so called because some of their fins are replaced by strong, sharp spines, the number of which is important in their classification. Instead of having scales, the body usually possesses a series of hard plates. There are both fresh-water and ocean species, the former attaining a length of from 2 in. to 4 in., and the latter of not more than 7 in. These fish have the peculiar habit of building muff-shaped nests of sticks and roots for receiving the spawn. The male carefully guards the spawn, and he also watches over the young for several days after the eggs are hatched. Sticklebacks feed voraciously on the young fry of other fishes.

Scientific Name. Sticklebacks comprise about a dozen species of the family *Gasterosteidae*. The three-spined stickleback is *Gasterosteus aculeatus*.

STIGMA. In botany. See FLOWERS.

STILL. See DISTILLATION.

STILT. A plover which, from the extraordinary length of its legs, looks as if it walked on stilts. Species of this curious long-legged bird are found in most parts of the world. In Europe the black-winged stilt breeds mainly in the Mediterranean regions,

though it is occasionally found near water in Britain.

Scientific Name. The stilt is of the family *Charadriidae*. It is *Himantopus himantopus*.

STILTS. Every one is familiar with the long walking sticks with foot rests, used by boys in their play, which enable them to cover the ground with very long steps. In some parts of Europe, particularly in Belgium and France, the peasants use stilts regularly when the lands are flooded. These practical



STILT-WALKING

Workers in the Kentish hop-fields wear stilts when stringing up the poles in readiness for the hops.

stilts are strapped securely about the leg below the knee, and the walker uses a long pole to help him maintain his balance. They are also used by workers in the Kent hop-gardens.

STING RAY. A ray fish whose most striking characteristic is the possession of a long, flexible tail with sharp spines on the back. These spines have cutting teeth along the edges. When irritated, the sting ray swings its tail upward and sideways, inflicting a most painful wound. The fish are found most abundantly in warm, shallow parts of the ocean, where they live on sandy or silty bottoms. They have a flattened, disk-like body, and may reach a length of 10 ft. or 12 ft. in tropical seas.

Scientific Name. Sting rays belong to the family *Dasyatidae*. There are about fifty species. The common sting ray is *Dasyatis centroura*.

STIRLING. The county town of Stirlingshire in central Scotland, on the River Forth,

40 miles from Edinburgh. It has a population of 22,593. It is served by the L.M.S.R. and L.N.E.R., and occupies the key position for road transport in central Scotland. Stirling grew round a castle which is situated on a high volcanic rock overlooking the river. Stirling is one of the oldest royal burghs in Scotland and was for long a favourite residence of the Scottish kings. The early history of the castle is lost in obscurity, but it has been outstanding in much Scottish history, and seven battlefields can be seen from its towers, notably Stirling Bridge and Bannockburn. The town abounds in historic buildings. The Smith Institute is a fine museum. The existing industries are many and various, including coal-mining; carpet weaving; the manufacture of agricultural machinery, nails, bolts, etc.; engineering; and joinery. The coal measures of central Scotland underlie the Stirling area, and the nearest coal pit is within a mile of the town.

STIRLINGSHIRE. One of the smaller shires of Scotland; it is 286,338 acres in extent and has a population of 166,447. Loch Lomond is on the western side, and the lakes and streams of the shire include Lochs Katrine and Arklet, and the Avon, Carron, Bannock, Endrick, and Blane. Its peaks include Ben Lomond in the north-west which attains a height of 3,192 ft., while of lesser elevation are Gargunnock Hills (1591 ft.), Kilsyth Hills (1503 ft.), Campsie Fells (1894 ft.), and Fintry Hills (1676 ft.). The valuable carse of Stirling and Falkirk were formerly covered with peat moss, but are now under cultivation. Coal and ironstone are mined in large areas. There are great ironworks at Carron and Falkirk; and the shire has manufactures of cotton and woollen goods, especially tartans and tweeds. Carpets and agricultural implements are also produced, and an excellent whisky. The Stirlingshire cattle are famous.

In Scotland the Carboniferous formation is almost entirely in the Central Lowlands between the Firths of Clyde and Forth. The coal seams, as in the Northern coal districts of England, are in the limestone series. The Stirlingshire coals are of excellent quality and the production is considerable.

The great place in history held by the principal town of Stirling is described elsewhere. The whole county was the scene of many conflicts, for it was a key position in the prolonged conflict between Scotland and England which preceded the Union. Many battles were fought in the county between Protestants and Catholics, and John Knox thundered out from every hamlet in the shire his fierce denunciations of the Roman Catholic Church. It was on the field of



STIRLING CASTLE

This almost impregnable castle barred the road to the Highlands for centuries. On the right is the main gateway built by James III.

Photos: L.M.S.; Taylor

Bannockburn, near the village of St. Ninians, in 1314, that Robert Bruce, future king of Scotland, intercepted a great army gathered by Edward II and completely defeated the English king. King James V of Scotland, a Stirlingshire-born Scot who was crowned in 1513 at the age of one year, is the "Fitz-james of Snowdon" of *The Lady of the Lake*. Sir David Lindsay's play *Satire of the Three Estates* was inspired in Stirlingshire. The shire is in the "Scott Country," and every

for the supposed inhabitation of the county by Stone Age man.

STITCHWORT. The most common plant of this genus is the chickweed, so well known to gardeners. The flowers of the common chickweed are always white, with five petals, and very tiny. Though the stem may be over a foot long, it does not commonly grow to that height. The flowers are solitary, the leaves egg-shaped, and the flower stem grows from their axils.

Scientific Name. The stitchwort genus is *Stellaria* of the clove-pink family *Caryophyllaceae*. The common chickweed is *S. media*.

STOAT. See **ERMINE**.

STOCK. See **SHARES AND STOCK**.

STOCK. A plant best known for its value in the garden, though wild varieties are also found occasionally growing in England. The flowers are purplish coloured in the wild kinds, and it is well-known that the great sea stock gives off its scent at night, as do some of the cultivated varieties.

The garden stocks are all biennials, and should be raised from seed planted in autumn in a greenhouse, and plants set out in the spring. It should be noted that, although the variety may be double flowering, a proportion of the plants will revert to type and show single flowers. Well-known varieties are: twelve-weeks stock, Belgian stock, the night-scented stock, and the small Virginia stock.

Classification. Stock form a genus *Matthiola* in the mustard family *Cruciferae*.

STOCK EXCHANGE. The recognized place or market for dealings in the stocks and bonds of Governments and municipal corporations and the stocks and shares of railways and other public companies engaged in any form of business enterprise. The most important Stock Exchange in England is that of London. Other stock exchanges



GREATER STITCHWORT

Photo: E. J. Hosking

literary tourist includes it in his explorations. Stirling and Falkirk are described separately. *Bridge of Allan* is a popular resort on the River Allan, famed for its magnesia waters and as a centre for the Ochil range, whose foothills rise at the eastern end of the town. Population (1931) 2897. *Grangemouth*, the chief port, is at the entrance to the Forth and Clyde canal; its 93 acres of docks export the products of the Carron ironworks and local collieries and sawmills. Population, 11,798. *Kilsyth*, to the south of the Kilsyth Hills, midway between Falkirk and Glasgow, has coal mines and ironworks. Population, 7551. Excavations have produced evidence

have grown up in all the leading cities of Great Britain.

As an organized institution the London Stock Exchange dates from the year 1801, when the building in which it is now housed was begun; but transactions in securities through agents or brokers, who assembled in central meeting-places (a coffee house was so used in the eighteenth century) and had the requisite knowledge of the "paper" (or documents) in which they dealt, are of very much earlier date.

The functions of the Stock Exchange as an institution are to provide facilities for purchase and sale of securities; to ensure that such securities have been legally created; and to choose and govern its members upon principles which shall protect the investing public against fraud.

Membership. Strict requirements are enforced on those who become members of the Stock Exchange. Financially these involve a substantial entrance fee and annual subscription, coupled with the purchase of three shares of the Stock Exchange and also a "nomination". This latter, which comes from a retiring member, has a high value. Together these qualifications will normally cost between £2000 and £3000. Of this sum £630 is entrance fee and £105 annual subscription. The shares and nomination are fluctuating investments. A further requirement of very great importance as guarantee of integrity is that the new member must have three sureties of £500 each for four years. When persons have had long experience and service of the Exchange, entrance to membership is less costly.

A committee for General Purposes is responsible for rules to govern admission to the Stock Exchange, watch over the conduct of the members, give permission to deal in securities, etc.

How the Exchange Works. A peculiarity of the London Stock Exchange is the division of members into jobbers (or dealers) and brokers. A member may be either; but he cannot be both at one time. Jobbers deal with brokers and have no direct contact with the public. They are not, like the brokers, agents of the investors. Jobbers "make" the prices; that is, they agree to buy shares or other securities at one price and to sell at another (slightly higher) price, obtaining their profit in the difference between the two prices—the jobber's "turn." The broker deals direct with clients, executing their orders for a commission. Scales of commission are settled by the rules of the Exchange. Brokers necessarily spend much more time in their offices than jobbers, who give almost all the official hours to occupying their positions, or "pitch," inside the

Exchange. At any moment of the business day the jobbers can be found at their accustomed spots. Jobbers attach themselves to various so-called markets—Gilt-edged, Industrial, Rubber and so forth; they do not attempt to deal here and there in anything and everything.

From the investor's point of view, the broker's is a better-known vocation than that of the jobber. Brokers are really the investing public's accredited agents for the purchase and sale of investments. Before any individual can use the services of a stockbroker he must obtain formal introduction to him.

After dealings have begun in any security, its price becomes subject to a variety of influences which may raise or depress it. Popular interest, good general trade, report and rumour, a succession of years of rising or falling profits, and "pools" (which are really "corners" in shares which are in short supply, and are officially denounced) may, of course, change the prices of shares profoundly. Investment science disentangles real causes of gain or loss from the artificial ones; but speculation pure and simple takes note of the market factors of the moment and endeavours to profit by them. Speculation in general is more broadly based: it calculates the visible and estimated possibilities and takes a risk in the hope of large, or at any rate adequate, gain. Variation of prices of securities is thus a reflex of innumerable influences, some at least of them not, as a rule, known to the people who are remote from the markets.

To make investments for the first time, a member of the public first of all secures an introduction to a stockbroker; or may, if he wishes, put the matter in the hands of his bank, who will save him all the formalities and carry the transaction through. His broker will supply him, on request, with information concerning an intended investment, but many firms refrain from making any recommendations. When an investment has been bought there are certain costs to meet—broker's commission and stamps and fee. The latter are, of course, matters of taxation, consisting mainly of the £1 per cent duty. As a rule, the total bill is some 2 per cent or more above the net cost of the security.

Investors can make sure that they are dealing with men of good faith and in securities which are based on definite assets by arranging their transactions through members of the Stock Exchange or through banks, which themselves must purchase or sell through the Stock Exchange: the banks do not use any other agency.

STOCKHOLM. The capital and metropolis of Sweden and the chief industrial centre of



STOCKHOLM
Photo OROC

that country. It is situated on the shores of Lake Mälär, at the point where the lake is drained by a small stream into a channel of the Baltic Sea. A part of the city occupies a network of islands and peninsulas. The old nucleus of Stockholm, called the *Staden*, which was founded by Birger Jarl about 1255, is built on an island in the stream; it is still a place of narrow, winding streets and quaint gabled houses.

Stockholm manufactures beer, sugar, cotton goods, tobacco products, furniture, soap, foodstuffs, and other commodities. Shipbuilding is an industry of importance. Connected by canal with the Baltic Sea, Stockholm ranks next to Gothenburg as a shipping centre. The harbour was recently enlarged, and in 1926 a new dock was completed, capable of accommodating the largest ships. Population (1934) 526,027.

STOCKPORT. The County Borough of Stockport, with a population of 130,600, is a neighbour of Manchester, and is 177 miles from London and 80 miles from Birmingham. It is on the River Mersey, partly in Lancashire and partly in Cheshire, being a town of the latter county for Parliamentary and Municipal matters. It is served by the L.M.S. and L.N.E. railways, and has tram and bus connection with Manchester. Its main industries are cotton spinning and felt hat manufacture, but it has a variety of other interests.

STOCKS. An instrument of punishment

for petty offenders, formerly used in Great Britain and other European countries; and in the American colonies, especially in New England, in the eighteenth century. The stocks consisted of a wooden structure, with a bench on which the culprit sat with his legs outstretched and his ankles confined in holes between heavy boards, the upper one of which was movable and could be locked in place. Sometimes the stocks included a pillory (which see). Confinement in the stocks was usually for several hours at a time, and besides causing physical discomfort, it made the culprit an object of public ridicule. The use of the stocks in Britain dates back to Anglo-Saxon times. The Statute of Labourers, a law of 1350, provided this punishment for unruly artisans, but inebriates were the usual victims.

STOCKS AND SHARES. See **SHARES**; **COMPANY**, **INVESTMENT**.

STOCKTAKING. By "stocktaking" is understood the recording of the quantities and calculating the value of the stock of a business. On the accuracy of the valuation depends the correctness of the Profit and Loss Account and Balance Sheet. Stock is usually taken on the last day of an accounting period, e.g. half year or year. The time of day and method of stocktaking will be decided by the manager or other official, who should be made responsible for it so that he may sign a certificate of stock valuation.

Stock is usually taken after business

hours, and the usual procedure is somewhat as follows. The various kinds of stock will already have been listed on sheets having columns for quantity and amount. Usually one member of the staff counts or measures the stock and calls the number, weight, etc., to another, who enters it in its appropriate place. Afterwards the values are calculated—usually at cost price or the present market price, if that is now the lower. There are, naturally, exceptions to this—in the case of wines, for instance, in which the value increases with age, the price might be higher.

STOCKTON-ON-TEES. This ancient market town of county Durham, on the north bank of the River Tees, had a population of 67,697 at the 1931 census. It is connected with the neighbouring Borough of Thornaby (population, 21,233) by bridge over the river. The two towns comprise the Parliamentary Borough of Stockton-on-Tees and return one member to Parliament. King John probably granted the town's first charter. The L.N.E.R. provides the rail transport, while road and river transport are excellent. In addition to its being an agricultural centre, Stockton has important industrial facilities, being close to large coal and mineral mines. The town is closely associated with the introduction of railways, as it was in May, 1822, that the first rail of the first public passenger railway (the Stockton and Darlington Railway) was laid in the town. The industries include engineering, stone quarrying, ironfounding, and large chemical works.

STOICISM, *sto'is iz'm.* Belief in the doctrines of Zeno, who was called "the Stoic philosopher," because he gave his lectures in a public porch, called *stoa* in Greek.

Zeno founded his school of philosophy in the latter part of the fourth century B.C. Its teachings were lofty and severe. At a time when the followers of Epicurus were telling the people of Athens that pleasure is the chief end of existence, the Stoics taught *virtue*, for its own sake, as the highest good. Because it was a pantheistic philosophy, contending that all reality, though material, is animated by God or reason, with which the soul of man is identified, happiness to the Stoics meant living in harmony with the divine order, with each accepting his destiny uncomplainingly. It was thus a practical philosophy, its followers practising self-control, courage, temperance, and justice, and repressing all emotion arising from pain or misfortune. One of their doctrines was that every human being is part of the same "world soul"—a *universal brotherhood* that should dwarf all difference of rank and nationality.

The Stoic philosophy made a strong appeal

to the Romans, and Epictetus became the founder of the New Stoic school, to which belonged also such great thinkers as Seneca and the Emperor Marcus Aurelius.

STOKE-ON-TRENT. The city of Stoke-on-Trent, Staffordshire, has a population of 276,639. It is served by the L.M.S. railway, and is 140 miles from London. The original pottery-making towns of Stoke, Burslem, Longton, Hanley, Fenton, and Tunstall



POTTERIES AT STOKE-ON-TRENT

Photo: Topical

united in 1910 to form the county borough of Stoke-on-Trent, and it was made a city in 1925. Its chief magistrate was given the title of Lord Mayor in 1928. The district is one of the industrial and commercial centres of England, with the making of pottery its chief occupation. In addition to the railway facilities of the district, it is well served by the Trent and Mersey canal, and by road transport. The industries of the town have the advantage of adequate coal supplies immediately available. In addition to the hundreds of potteries, there are chemical works, locomotive works, brick and tile, and engineering works.

STOMACH, *stum'ak.* A dilated portion of the alimentary canal, below the oesophagus. It is a muscular sac lying in the upper left side of the abdominal cavity, and shaped rather like a pear, with the large end upwards and the narrow end bent to the right. The main part of it, or *body*, into which the oesophagus opens, is extremely variable in shape, and is continuous with a constricted lower portion known as the *pylorus*, which leads into the small intestine.

The stomach varies in form and size, especially according to the amount of food which it contains. When nearly empty, it presents throughout a narrow, tube-like form. When filled with food, it may be distended to considerable limits. The average capacity of the stomach is about a quart. Its functions are—

(1) To reduce the food to a viscid, pulpy liquid.

(2) To begin the digestion of proteins.

(3) To supply *hydrochloric acid*, which is believed to assist in dissolving the food, to prevent bacterial action in the stomach, and to act as a stimulus to the secretion of the digestive juices in the small intestine. This latter function, however, is being questioned in very recent work done by physiologists.

(4) To pass the food on to the intestines in comparatively small quantities, at short intervals.

The stomach accomplishes these functions in the following ways: the food is introduced into the stomach at its upper end, from the oesophagus. By means of the powerful muscles with which the stomach is supplied, rhythmic contractions are set up which start at the upper end and pass in ringlike formation toward the lower end. This does two things: it propels the food toward the pyloric end of the stomach, and it also reduces the food to a pulpy mass. When the food reaches the pyloric end, it is prevented from going farther by a *sphincter*, which opens only at certain intervals, when the food is ready to be passed on to the intestines.

When the food is in the stomach, in

addition to being mechanically reduced to pulp, it is acted upon by the *gastric juice*. This juice is a whitish fluid secreted by glands in the stomach, and contains water, salts, mucus, hydrochloric acid, and two ferments—*pepsin* and *rennin*. So far as is known, rennin acts only on milk, while pepsin begins the digestion of the proteins. This digestion is incomplete, and the process is carried on to completion in the small intestine. Carbohydrates and fats are not acted upon in the stomach.

STONE. The earth's crust is composed of mineral matter, large pieces of which are termed "rocks" and smaller ones "stones." Rock that has been quarried and shaped is used extensively for building and is known as stone (see BUILDING STONE). Among the best known stones are *limestone*, which contains a large proportion of calcium carbonate; *sandstone*, consisting of sand grains held together by some binding medium; and *granite*, igneous rock of volcanic origin. *Marble* is a limestone crystallized by heat and pressure, and these also are the causes of the formation of *slate* from sandy clay.

STONE AGE. The discoveries of shaped flints and their classification into series have



PORTLAND STONE QUARRIES, ISLE OF WIGHT

Photo: Taylor



PETERHEAD GRANITE

Light greyish blue and grey.



SLATTIE GRANITE

A good granite, chiefly grey and white, with a few black spots.



FORTLAND STONE
(Whitbed)



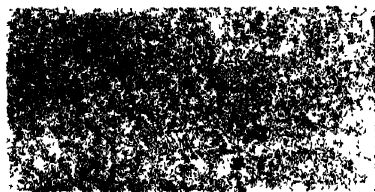
BATH STONE
(Monk's Park)



FOREST OF DEAN
STONE



HAM HILL STONE



LIGHT HOPTON WOOD

An excellent stone for paving, for outposts, and also for building, and for other purposes.



KILTON STONE

had important effects on the study of man (see ANTHROPOLOGY). They lent support to the theory that man's antiquity was greater than the early nineteenth century generally

little light is thrown on the problem of origins, since the series is not evidence of local evolutionary growth, but rather of successive peoples bringing their culture

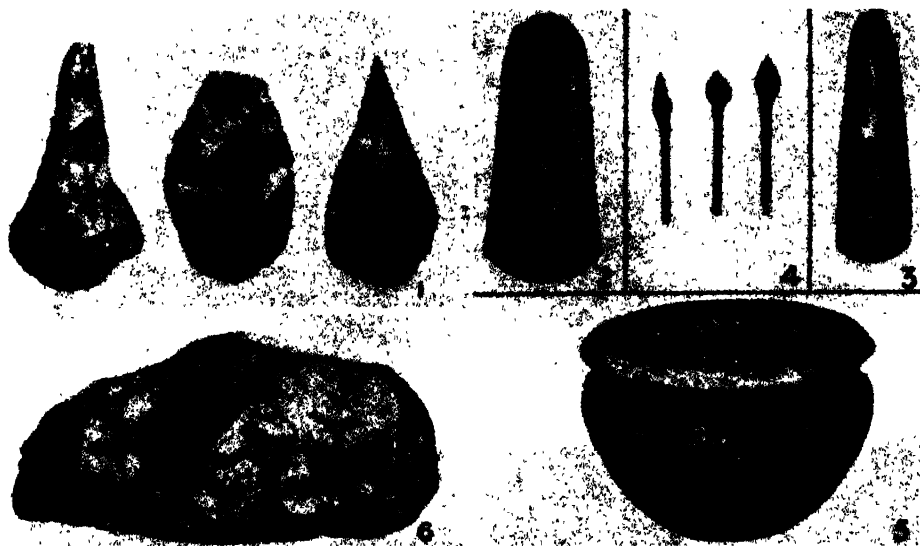


TYPICAL STRUCTURES IN STONE

On the left is basalt, in the centre granite-porphry, and on the right shelly limestone.

supposed, and paved the way for the study of man's cultural history. The terminology which resulted is now become misleading. It is unsatisfactory to name a culture by the material of which some of its tools are made,

with them. Thus each label represents a phase in the life of a locality, and must not be regarded as descriptive of the cultural condition of all peoples—even in Europe—at any particular century. For example,



STONE AGE IMPLEMENTS

1. Palaeolithic hand-axes found in England. 2 and 3. Neolithic flint axes, chipped and polished, recovered from the Thames. 4. Leaf-shaped Neolithic arrow-heads found in England. They are bound to modern shafts. 5. "Peterborough" type Neolithic pottery found at Hedsor on the Thames. 6. Rostro-carinate found at Whittingham in Norfolk.

Photos: British Museum

without reference to other more important elements, or even to the physical type of the people themselves. Again, the sequence refers most correctly to Western Europe; thus

Britain still had its flint and hunting technique whilst the Near East had highly developed agriculture, metals, and architecture; and in Europe such elements as

iron were used in the Aegean about 1000 B.C., but in Britain the Iron Age was still only dawning down to Roman times.

Using the terms merely as convenient labels, we arrive at the following sequence—

1. *Eolithic* (= dawn Stone Age): much-disputed flints with little attempt at shaping, found in geological periods earlier than Pleistocene; used by extinct sub-men who were food-gatherers.

2. *Lower Palaeolithic* (= earlier Old Stone Age): chiefly heavy-core implements, especially the "hand axe" or *coup-de-poing*, flaked for hunting and domestic use. The last phase is Mousterian, and associated with the last of the sub-man types.

3. *Upper Palaeolithic* (= later Old Stone Age). This marks the arrival of *Homo sapiens* in Western Europe. Chiefly flakes are found rather than core artifacts, with a wide range of uses, including engravers. These peoples were hunters and fishers. The Cro-Magnons (Magdalenian period) represent the highest stage of Palaeolithic culture; they were expert in shaping stone celts, carving implements in bone, and painting in colour, though still ignorant of the use of metals.

4. *Neolithic* (= New Stone Age): polished stone axes or "celts," i.e. chisel-shaped tools. The main importance of the name is that these peoples were agricultural, i.e. civilized food-producers.

The term *Megalithic* (= large stone) is still sometimes used as a period label. It properly refers to the monuments of large stones, chiefly burials, common to the coastal regions of Western Europe, and probably the work of early metal prospectors.

Bronze implements began to come into Britain possibly about 2000 B.C., flint still being used; hence the phase is called *Aeneolithic* (= Bronze and Stone Age).

STONE-CHAT. A small bird which gets its name from its very characteristic alarm note. Species of stone-chat are found in

Europe, Asia, and Africa. The European species is a common resident bird in Britain, though rather restricted in its distribution. It is usually found in open country in which there are scattered low bushes.

In summer the male has a black head and throat, with a conspicuous white patch on the neck and wings.

Scientific Name. *Saxicola torquata*.

STONECROP. A family of plants distinguished by their small, fleshy, often pink-tipped leaves which cling tightly all up the stem, their bright star-like flowers which may be white, pink, yellow or reddish-purple, and the fact that they grow upon rocks and stones and appear to need little moisture. This last belief is not strictly true, for they store up moisture in the fleshy leaves and stems, and there are varieties which will not live in bare arid situations. The English and the biting stonecrop, which has a bitter juice, are two of the most common varieties. See HOUSELEEK.

Scientific Names. The stonecrop family is *Crassulaceae*. The English stonecrop is *Sedum anglicum*; the biting, *S. ocre*.

STONEHAVEN. See KINCARDINESHIRE

STONEHENGE (-heng). See PREHISTORIC BRITAIN.

STONEWARE. See POTTERY.

STOOLBALL. A traditional English game, considered the forerunner of the modern game of cricket. It appears to have originated in the north of England, but it is uncertain when it was first introduced; for instance, a fifteenth-century manuscript is quoted as follows: "Hand ball, fott ball, stoll ball and all manner other games out cherchyard"; and in the sixteenth century we read that complaints were made against the police to the effect that they had permitted stoolball to be played on a Sunday. At all times it has been primarily, but not exclusively, a game for women.

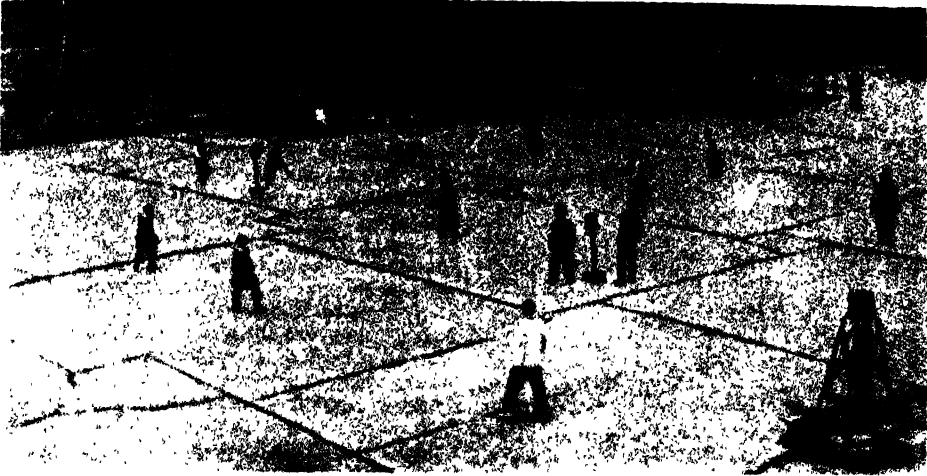
In the early game a stool or wicket was placed on the ground. A player took up a position in front of it and was bowled at by another player as in cricket. The "batsman" was required to defend his stool with his hands, the method of hitting being similar to that employed in the modern game of fives. One point was scored each time the player succeeded in hitting the ball. He was given out if the ball hit his wicket, or if he were caught.

STORAGE BATTERY. It is *chemical energy* which is stored in a storage battery. When the proper electrical connections are made, this chemical energy is transformed into *electrical energy*.

The difference between a storage battery and other electric batteries is that, in all



COCK STONE-CHAT AND YOUNG
Photo: E. J. Hoobling



STOOLBALL MATCH IN PROGRESS

Photo: Photopress

other batteries new solution and new zinc plates must be supplied when the battery is run down, while in the storage battery the plates and the solution are renewed by passing an electric current through the battery from some other source, and in a reverse direction from that in which the current flows out of the battery.

The plates of commercial storage cells are usually in the form of *grids*. The apertures in the positive plate are filled with lead peroxide, and those of the negative plate with porous lead. When the cell is discharged, both plates consist of monoxide of lead.

In the Edison type battery, the plates are formed of grids of sheet steel. The grids of the plates which form the positive electrode are filled with nickel hydroxide; the plates forming the negative electrode are filled with an oxide of iron (ferrous oxide) mixed with graphite. The liquid is a solution of caustic potash (potassium hydroxide). The merit of this type of battery lies in the fact that it will stand, without injury, severe usage which would destroy a lead battery. It has greater capacity in ampere hours in proportion to weight than a lead battery. The voltage of the Edison battery is about 1.1 volts for each cell, while that of a lead battery is 2 volts. The voltage drop when these cells are first switched into circuit is, however, rather large, a fact which renders them less suitable than lead-acid batteries for some purposes.

STORK. A very common bird on the continent of Europe, but a rare visitor to Britain. The best-known species are the white stork and black stork. The former is

almost domestic in its breeding habits. Typically it nests in trees, but throughout its breeding range, from northern Europe to North Africa, it is commonly found in the vicinity of buildings, either nesting on a dis-



STORKS ON ROOFTOP IN POLAND

Photo: Krystone

used chimney or on some other convenient stance. It is generally considered lucky to have a stork about the house. The black stork is much less domestic in its habits. Attempts have been made to introduce the white stork to Britain.

Storks are fairly large birds, made to look much larger by their long legs and neck. The white stork stands about 3 ft. high. Their food is mainly insects and frogs. In



AMERICAN STORKS

Photo: Visual Education Service

the autumn these storks migrate from Europe to South Africa.

There are several other species of stork, for which see ADJUTANT; MARABOU.

Scientific Names. Storks are of the family *Ciconiidae*. The white stork is *Ciconia alba*; the black stork is *C. nigra*.

STORMS. Disturbances of the atmosphere, marked usually by strong winds, rain, snow, or hail, or by a combination of two or more of these. If the temperature of the air were everywhere equal, storms would be unknown. But the sun warms the air unevenly; its heating action is greatest at the equator and is least at the poles. Heated air expands, the upper layers flowing off into the surrounding regions, cooling as they go. This reduces the atmospheric pressure over the warm areas, and increases it elsewhere. Air on the lower levels is thus driven into the centre of low pressure, and a rotary circulation on a vast scale is maintained by the action of the sun's heat and the pull of gravitation on the atmospheric envelope.

Storms are known as *general* and *local*. The former alone are described here. Such storms may cover a low-pressure area having a diameter of from 500 to 1000 miles, but they are not often violent. They are accompanied by shifting winds and more or less rain or snow. Technically, they are known as *cyclones*, or *cyclonic storms*. Storms which occur in areas of high pressure, rather than of low pressure, are given the name *anti-cyclonic storms*.

Cyclonic storms of this nature have well-defined areas on nearly every continent. They have an almost uniform progress from west to east, and it usually requires eight or ten days to complete a cycle; for this

reason, storms and fair weather succeed each other at frequent intervals.

Thunderstorms are by far the most numerous of all. No fewer than 45,000 of this variety of storms occur every day over the surface of the earth.

Cyclones or depressions are caused, in temperate regions, by the meeting of warm, moist equatorial air blowing to the north-east, and cold, less humid polar air flowing to the south-west. The line of meeting is called the polar front. The warm air tends to rise into and above the cold air, and thus a bulge develops. Here an eddy is formed, eventually surrounded by cold air. The centre has a lower pressure than the surrounding area, and is a region of heavy rain and strong winds. The eddy moves onward in the general stream of westerly wind, causing wild weather as it proceeds. These are the usual storms of temperate regions.

For thunderstorms, see that title.

STOUT. A strong alcoholic liquor brewed from dark malts, and hops, with the addition of caramel; soft water is essential. The oatmeal and invalid grades are useful in convalescence.

STOW, *sto*, JOHN (1525?-1605). Stow, who was a tailor by trade, is remembered to-day as an antiquarian who made a famous collection of old books and manuscripts (many of which he edited), and for his historical work *The Chronicles of England from Brute unto this present yeare of Christ*, 1580.

STOW-ON-THE-WOLD. See GLOUCESTERSHIRE.

STRABO, *strah' bo* (about 64 B.C.—about A.D. 21). A Greek geographer and historian. He was born at Amasia, in Pontus, removed to Rome when he was about thirty-five years of age, and made that city his home for many years. He travelled extensively, however, in Egypt and through southern Europe and northern Africa. It was on these journeys, supplemented by the works of earlier writers on geography, that his great *Geography* was based. The seventeen books of this work are extant, the first two dealing with physical geography, the next eight with Europe, six with Asia, and one with Africa. It was the most important work on geography produced before the Christian era.

STRACHEY, *stray' che*, GILES LYTTON (1880-1932). An English writer, notable for contributing a distinctive type of biography to modern English literature. He was born in London, the son of Lieutenant-General Sir Richard Strachey, and educated at Trinity College, Cambridge.

Strachey's first book, *Landmarks in French Literature*, appeared in 1912. It

was admirably written and brilliant in style. His real fame, however, began in 1918 with the publication of his *Eminent Victorians*.

The success of the book was immediate; it revealed high qualities of wit and learning, a combination unusual in biographical writing until then. The outstanding features of the new biography are that it is essentially dramatic in design, and is written in the form of the novel. As a whole, the treatment is both realistic and imaginative, and there is a tone of faint mockery which is never allowed to become too insistent. Historical facts are used as a basis, but they are organized according to a well-designed dramatic pattern.

Strachey's succeeding books continued to enhance his reputation. In addition to the two works mentioned above, he published *Queen Victoria, Books and Characters*, *Elizabeth and Essex*, and *Portraits in Miniature*.

STRADIVARIUS, *strad i vair' ius*, ANTONIO (1644-1737). Celebrated craftsman whose genius was directed mainly to the making of violins. He was born at Cremona, Italy, and early entered the employ of Nicola Amati, a Cremonese master of violin-making. Not until 1690 did he free himself from the traditions of the Amati school and begin to exhibit a style of his own. From 1700 to 1715 his instruments reached the height of perfection, not only in brilliance of tone and power, but in the excellence of form and wonderful precision with which the minutest detail was executed. He seldom afterward deviated from his standard pattern. The Stradivarii of his later period were made under his direction. Many instruments claimed to have been made by him belong to a later date. See VIOLIN.

STRAFFORD, THOMAS WENTWORTH, FIRST EARL OF (1593-1641). A famous English statesman. He was born in London, of an ancient family, educated at St. John's College, Cambridge, and in 1614, 1621, 1624, and 1628 was elected to Parliament.

In the second Parliament of which he was a member, Wentworth stood strongly for the rights of that body, and this spirit of resistance to the aggressions of the king characterized him also in the first Parliament of Charles I. He did not, however, sympathize with the Puritans nor share their intense hostility toward the Crown. Nevertheless, he was a bitter opponent of the Duke of Buckingham and was foremost in his advocacy of the Petition of Right in 1628.

After the murder of Buckingham later in the year, Wentworth transferred his support to the king. He was thereupon appointed to the presidency of the Council of the

North; six months before, he had been created Baron Wentworth, and on 10th December, Viscount Wentworth. In his dealing with affairs in the north, he showed himself very eager to restore order, but governed on absolutist principles and with complete disregard of popular sentiment. In 1633 he went as lord deputy to Ireland and there applied the same principles. He was in closest touch with Laud, Archbishop of Canterbury, and together they strove to restore the Tudor example. Wentworth was consumed with a love for administrative efficiency, to which he gave the name of "Thorough." But his ruthless despotism brought upon him the hatred of Parliament and the people.

Returning to England in 1639, he was created Earl of Strafford, and was consulted by the king on all important questions. The Presbyterians of Scotland had become troublesome, and Strafford advised the king to make use of Irish troops against them, and to assert his royal prerogative in every possible way. When the Long Parliament met in November, 1640, it at once determined to impeach Strafford for his administration of Ireland, and the king summoned him to London, promising that he should not suffer "in life, honour, or fortune." Parliament dropped the impeachment, for he was obviously innocent of treason, an offence against the king, and in May, 1641, passed a bill of attainder. The unfortunate earl released Charles from his promise, and the king, intimidated by the violence of the London mob gathered in Whitehall, signed the bill on 10th May. Two days later, Strafford was executed. His death was followed by the total collapse of the edifice of absolutism which he had so carefully built up.

STRAIN. In surgery. See SPRAIN.

STRAITS SETTLEMENTS. A British crown colony on and adjacent to the southwestern part of the Malay Peninsula, including the settlements of Singapore, Penang, Malacca, and Labuan. They are named from the straits (Malacca) that separate the peninsula from Sumatra. The colony has a total area of 1356 sq. miles and a population of 1,119,186 (1935). There are about 9500 whites; the Asiatic inhabitants are chiefly Chinese, Malays, and natives of India. Malacca was Portuguese from 1511 to 1641 and Dutch until 1795, when the English captured it. Penang was ceded to the East India Company in 1786, and Province Wellesley in 1800. Cocos Island and Christmas Island were brought under control of the colony in 1868 and 1889 respectively. Both islands were later incorporated with the Settlement of Singapore. The Straits Settlements were ruled from India until 1867. They

are now under a governor resident in Singapore (which see).

Penang settlement consists of the island of Penang (100 sq. miles, population (1935) 197,685), sometimes called Prince of Wales Island, off the west coast of the peninsula; Province Wellesley, a strip of land (280 sq. miles) opposite the mainland (population, 144,219); and the Dindings, consisting of the small island of Pangkor, off the west coast, and a corresponding strip of mainland territory. Penang is largely a jungle, but fertile and productive where it has been cleared.

Malacca (which see) is on the western coast of the peninsula, between Penang and

stems, often reaching a height of 5 ft. It bears heavily-scented, white, trumpet-shaped flowers and large, smooth, green sharp-pointed leaves, from 3 in. to 8 in. long. The prickly, bur-like pods contain wrinkled black seeds which, like the leaves, are used in making the drug called stramonium. This drug is used principally for the relief of asthma. The plant is widely distributed throughout the warmer parts of the world.

Scientific Name. Stramonium belongs to the family *Solanaceae*. It is *Datura stramonium*.

STRANGLES. A disease of colts. See DISTEMPER.

STRANRAER, *stran rar'*. Burgh and port of Wigtownshire, lying at the head of Loch Ryan, and a well-known holiday and health resort. It is served by the L.M.S.R. and is a little over 100 miles from Edinburgh. There is steamer communication with Larne and the North of Ireland, the passage to Larne being only just over 40 miles. The town has a certain agricultural business, but it is chiefly as a tourist centre that it is important. Large catches of herring are often made in the loch. Stranraer was made a Royal Burgh by James VI in 1617. In the centre of the town is the old castle of St. John, said to date from 1520. The ancient province of Galloway, at the western end of which is Stranraer, has a wealth of historical associations, and is famous in song and story, Sir Walter Scott and Robert Burns having written of its romance and charm. Population (1931), 6,420.

STRASBOURG, *straks' boor*. See FRANCE.

STRASS. See GEMS.

STRATFORD-UPON-AVON. A Municipal Borough and market town of Warwickshire, famous as the birthplace of William Shakespeare, with an area of 6900 acres and a population of 11,616 in 1931. The new memorial theatre is the scene of an annual Shakespearian festival. The house in which Shakespeare was born is open to visitors; adjoining it is a museum containing many manuscripts and pictures representing his work and times. The Shakespeare memorial library is a unique collection of early editions of Shakespeare's plays, whilst the home of Anne Hathaway at Shottery is a thatched and beautifully preserved example of an Elizabethan farmhouse. The house of Judith Quiney, Shakespeare's youngest daughter, and of Mary Arden at Wilmcote are also well-preserved, finely-timbered houses open to inspection by the public. Other features of interest in the town include Clopton Bridge, a late fifteenth century structure



SHAKESPEARE MEMORIAL THEATRE

Singapore. It has little trade nowadays. The island of Labuan (which see) lies off the north-west coast of Borneo. The Cocos and Keeling Islands are a group of small coral islets in the Indian Ocean, 1200 miles south-west of Singapore; population, 1142. They have a cable station. Christmas Island (which see), in the Indian Ocean, is important for its export of phosphates.

Singapore, on the island of that name, and Georgetown, on Penang, are the chief ports, and from them are shipped vast quantities of tin, spices, rubber, gum, rattan, sugar, coffee, and other tropical products. Singapore is the capital of the Straits Settlements. The Governor is aided by an executive council and a legislative council, which is mainly non-elected. Education is provided for the natives, and school attendance is compulsory. See also MALAY PENINSULA.

STRAMONIUM, *strá mo' níum*. A poisonous, ill-smelling weed of the nightshade family, whose seeds and leaves have medicinal value. It has forked, yellow-green

with fourteen arches; the Guild Chapel, the foundation of the Guild of the Holy Cross, with fifteenth-century chancel and early sixteenth-century nave and a fresco of the Day of Judgment. Stratford Grammar School, at which Shakespeare was educated, has recently celebrated its quinqucentenary. The town is of very great antiquity and is known to have possessed a monastery towards the close of the seventh century. Its first charter for a weekly market was granted by Richard I, was followed by a long succession of charters for annual fairs, of which only the Stratford Mop has survived.

STRATHCLYDE. This Celtic kingdom seems at one period to have included Cumberland and Westmorland, although by the eighth century it had probably shrunk to little more than the area suggested by its name. Its capital was Dumbarton. Of its history little is known; its forces are mentioned as striving at different times with the Scots and with the Northumbrians. In the ninth century, Strathclyde was despoiled by the Northmen. Edward the Elder forced admission of his overlordship, and the Strathclyde warriors shared in 932 in the great defeat of Brunanburgh at the hands of Athelstan. During the eleventh century, Strathclyde passed into the control of the kings of Scotland.

STRATIFICATION. See GEOLOGY.

STRATIFIED ROCKS. Sandstone, shale, and sometimes limestone are formed in layers. These layers are called *strata*, and rocks formed in layers are *stratified rocks*. Stratified rocks have been formed of sediments which were first loose material and later became more or less consolidated to make rock. As originally formed, the layers were practically horizontal, but by folding of the earth's crust they have, in many places, been thrown out of their former position, and are now in many different positions, from horizontal to vertical. The angle of inclination which these layers form with a horizontal plane is called the *dip*.

STRATIGRAPHY. A branch of the science of geology, in which the rocks of the earth's crust are arranged in the order of their formation, and which interprets as far as possible the historical sequence of events from the records which they contain. Its chief work is the painstaking study of the strata as seen in coastal sections, or at the surface, in quarries, mines, and railway cuttings, etc.; but it takes from other branches of geology (such as palaeontology, petrology, mineralogy) those facts which are needed to explain the history of any tract of land from the earliest geological times until now.

STRATOSPHERE. The upper portion of

the atmosphere, beginning about 6 miles above the surface of the earth in high latitudes to 9 or more over the equator. This rarefied layer, of unknown depth, has an almost constant temperature with height, of around -60° F. in polar regions and -90° F. in the tropics. It is sometimes called the *isothermal region*. Clouds of water never form in this belt, and there is practically no convection. Unmanned balloons containing instruments have been sent up as high as 100,000 ft. in search of information, but Professor A. Piccard in 1932 was the first person to reach the stratosphere in a balloon, and later two American officers in an airtight globe ascended to a height of over 14 miles. See BALLOONS; COSMIC RAYS.

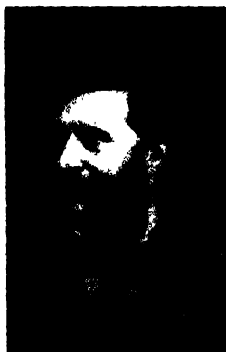
STRATUS, stray' tus. A kind of cloud (which see).

STRAUSS, JOHANN (1825-1899). An Austrian composer, born at Vienna. In 1844 he left home to conduct a restaurant orchestra at Hietzing, Austria. There he began to present his own compositions, mainly waltzes. In 1849 he began a series of tours of Europe.

In 1855 he became conductor of summer concerts in St. Petersburg (now Leningrad) and from 1863 to 1870 was conductor of the Russian Court balls.

Strauss's dance compositions, numbering several hundred, include *Blue Danube*, *Artist's Life*, *One Thousand and One Nights*, and *Wine, Women, and Song*. He composed also several successful operettas, among them *Indigo*, *A Night in Venice*, and *Prince Methusalem*.

STRAUSS, RICHARD (born 1864). A German composer. He was born in Munich. Before he was sixteen years old, his songs were becoming well known, and his *Symphony in D Minor* was being played by



JOHANN STRAUSS
Photo: Brown Bros.



RICHARD STRAUSS
Photo: U. & U.

several eminent pianists. Even Bülow, who was a merciless critic, praised his work and had his *Serenade* performed at Meiningen, Germany.

In 1885 Strauss succeeded Bülow as conductor of the Meiningen orchestra.

Between 1887 and 1904 he produced the compositions on which his fame chiefly rests. These include the tone poems *Don Juan*, *Macbeth*, *Till Eulenspiegel*, and *Don Quixote*; the *Domestic Symphony*; and the operas *Güntram* and *Feuersnot*.

His chief compositions after 1904 were operatic works. These include the brilliant *Salome* and *Elektra*; *Der Rosenkavalier*, and *Intermezzo* (1924).

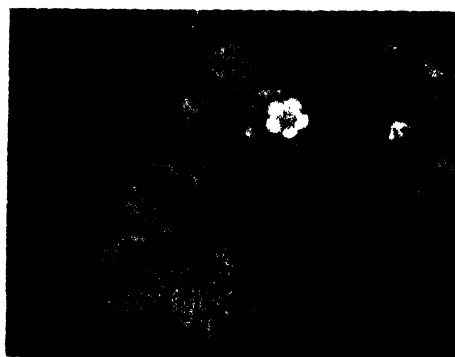
STRAVINSKY, IGOR FEDOROVITCH (born 1882), Russian composer and conductor. His music is in the direct Russian tradition, and was greatly inspired by Rimsky-Korsakov. His early style is typified in the brilliant ballet, *The Fire Bird* (1910), one of the many compositions produced for the great patron and impresario of the Russian ballet, Diaghilev. Two years later, *Petroushka* appeared, in the opinion of many, the composer's best work. But in 1913 a change of style occurred with the highly modernistic *Sacre du Printemps*, one of the most controversial compositions of its decade, and perhaps a very fine work. More recent productions reflect a further development of style in the classical austerity of *Apollo Musageles* (for strings alone) and of the *Symphonie des Psaumes*, for choir and wind orchestra. Of Stravinsky's brilliance and attractiveness few musicians are in any doubt, but a certain restlessness apparent both in such stylistic instability and, perhaps, in the music itself, suggests that while his works give great pleasure, the main line of contemporary musical development lies elsewhere.

STRAW. A substance consisting of the dried stems of oats, wheat, rye, barley, and other grains. As a coarse feed for livestock, as bedding for animals, and as a material in manure for fertilizing, straw is used in large quantities. Straw has been utilized by some chemical companies in the production of carbon, phenol oil, pitch, and acetic acid, these being extracted by special processes. It is also used in the manufacture of hats, baskets, saddles, bottle covers, paper, suitcases, and strawboard for mounting and binding. Even though looms have been invented for straw-weaving, much of the work is still done by hand. China and Japan are the principal countries in which this handicraft is practised. The modern straw hat industry of England is centred in Luton. Especially fine work in straw-plaiting is done in Tuscany, where the well-known legborn braids are made from a kind of straw.

STRAWBERRY. The luscious red fruit of a plant of the rose family. The plant is of trailing habit, and the leaves are borne in clusters of three.

The strawberry is not a berry in the technical sense of the word, for it is a fleshy, swollen seed receptacle bearing the dry, yellow seeds upon its pitted outer surface; the star-shaped hull that is removed before the berry is eaten was, early in the season, the calyx of the blossom. Not every blossom will produce fruit, for some lack stamens and need to be grown in the neighbourhood of staminate plants, so that their seeds may be fertilized by the pollen. See CROSS-POLLINATION.

Cultivation. Strawberry plants are propagated from runners taken from plants



WILD STRAWBERRY

Photo E. J. Hocking

planted a year previously, and no plant should be retained more than three years for fruiting purposes unless it is especially vigorous. Both spring and autumn planting are practised, but if the climate is severe, autumn planting necessitates a great deal of attention in the way of covering the bed. Usually strawberries are set in rows and the runners allowed to mat. In the row the plants are from 15 in. to 18 in. apart, while the rows themselves have 3 ft. or 4 ft. between them, to allow room for cultivation.

Any good garden soil is suitable for strawberry-growing.

Strawberries require a great deal of water, and continual stirring of the soil will cause the top layer to act as a mulch, and prevent the escape of moisture from below. This constant hoeing is far more satisfactory than watering. In the event of prolonged drought holes can be dug in the row at intervals of 2 ft. or 3 ft. and a half gallon of water poured into each. The soil should then be raked over.

Scientific Name. Strawberries are in the genus *Fragaria*. The common English wild strawberry is *F. vesca*.

STREAMLINE. A modern word implying that the surface resistance of any object has been reduced to a minimum. The theory that the speed of an object in motion is dependent rather upon the shape of its hinder than upon its forward portion, was well known in the early days of shipbuilding. The "three-decker" first rate ships of the Navy had the bow lines of a cod and the quarters or stern lines of a mackerel below water. By *streamlining* the projectiles of a gun, the range obtainable can be roughly doubled. Streamlining is being employed increasingly in modern transport.

STRENGTH OF MATERIALS. A term used to indicate the resistance offered by such materials as stone, wood, and steel to stresses tending to change their shape. Several sorts of stress are usually distinguished. There is a *tensile*, or stretching, stress, resistance to which is known as tensile strength. *Compressive* strength is resistance to such crushing masses as pillars support. *Shearing* strength is resistance to forces acting transversely to the material. In addition to these, there is a *torsional*, or twisting, stress, but this is really a combination of the larger classes first named.

STRENGTH OF MATERIALS IN POUNDS
PER SQUARE INCH

MATERIAL	TENSILE STRENGTH	CRUSHING STRENGTH	SHEARING STRENGTH
Cast iron	from 30,500 to 10,800	130,000 50,000	12,000 8,700
Wrought-iron	from 67,000 to 33,500	50,000 (average)	49,000 22,400
Steel plates	from 65,000 to 110,000	---	50,000 83,000
Steel boiler plates	66,000	---	56,000
Rivet steel	65,000	---	55,600
Copper, rolled plates	31,000	---	---
Copper, annealed wire	45,000	---	---
Brass	from 17,500 to 29,000	---	---
Cast zinc	7,500	---	---

Materials are said to have elasticity, and the limit of elasticity is not exceeded as long as the material resumes its shape when the stress is removed. When, however, the material becomes "set," it is said to have reached the *yield point*; and in building, the stress at the yield point, rather than the breaking point, is what matters.

Steel and wrought iron offer the stoutest resistance to pulling strains. Wood, which does not bear a great tensile stress, has what is known as a greater elastic range than steel or iron; that is, it bends more under a given pressure. Most materials will withstand a severer crushing than pulling strain, but

this is not true of wood. Cast iron will withstand a very heavy crushing strain, and for that reason it is commonly employed in the spans of bridges and in the foundations of modern buildings. The tenacity of materials is put to the hardest test under twisting strains.

STREPTOCOCCI, *strep tō koh' sē*. The causative bacteria of erysipelas and forms of pneumonia and septicaemia.

STRESEMANN, GUSTAV (1878-1929), German industrialist and statesman. When Stresemann entered industry in Saxony it was disjointed and neglected by the authorities, but his energy and organizing ability rapidly effected a change, and he was able to secure proper recognition for industry in the Saxon Chambers. Stresemann himself became a member of the Reichstag when only 23, and his brilliant oratory brought him to the notice of Bassermann, leader of the National Liberal Party, to which he belonged, and to the leadership of which he succeeded



STRESEMANN
Photo: Fox

in 1917 on the death of Bassermann. Failing to unite the Liberals in Germany after the revolution, Stresemann formed the German People's Party, which changed gradually from monarchist to republican views. Becoming Chancellor and Minister for Foreign Affairs when the currency had collapsed, Stresemann inaugurated a definite peace policy, and by opening negotiations with France over the position in the Ruhr, he was successful in stabilizing the currency and in paving the way for an international loan which helped to restart industry. Further results were the entry of Germany into the League of Nations and the Locarno Pact. Stresemann was awarded the Nobel Peace Prize jointly with Monsieur Briand in 1926.

STRIKE. The action of a body of workers in ceasing work in order to force an employer to grant their demands as to payment, hours of work, etc. When employees leave their work, not because of dissatisfaction with their own conditions, but in an endeavour to force the settlement of a strike of employees in another firm or undertaking, their act is known as a *sympathetic strike*. A *general strike* is a concerted withdrawal from work in numerous and diverse trades, sometimes

to achieve economic ends, and sometimes political ends. A *lockout* is the reverse of a strike; that is, it is the refusal of an employer to permit his employees to work until they have submitted to his terms.

Picketing is a method used by strikers to prevent others from taking their places. The pickets take positions outside the factory or other place and try to persuade strike-breakers to refuse to work.

It was about the middle of the eighteenth century in England—when various industries were revolutionized by the invention of labour-saving machinery, by the greater division of labour, by the rapid growth of the factory system and by improvements in transport—that the trade-union movement appeared in embryo, with the strike as its potential and powerful weapon. Men, women, and children struggled to add to the household income by working long hours at meagre wages in the factories, and after a time grave labour riots, involving the destruction of labour-saving machinery, were common occurrences. The employers obtained legislation against much of this disaffection and, on the other hand, trade unions started to appear among the highly-skilled workmen. In 1799, however, the Government of the day passed legislation making combinations of workmen illegal if they existed for, among other things, the promotion of strikes. The result was that industrial strife became far worse, and further legislation in 1824 permitted the existence of trade unions. Failures of several small strikes, however, discouraged the movement. Little was heard of trade unions until the period 1855 to 1875, but even during this time strikes were discouraged as wasteful and injurious in the long run. The London dock strike of 1889, led by Ben Tillett, resulted in the formation of many new types of trade union which tended to rely on the strike as their chief weapon. In 1901 occurred a strike on the Taff Vale Railway, and this resulted in the famous legal fight between the railway company and the Amalgamated Society of Railway Servants, the outcome of which was the decision of the courts that the trade union must pay damages for the loss incurred by the strike. Five years later, however, the Government was persuaded to pass the Trade Disputes Act, which freed the trade unions from further actions of the same nature.

Considerable unrest culminated in the great strike fever of 1911-12. In 1911 occurred a big railway strike, and in 1912 a great strike took place in the mining industry, resulting in Government interference and the setting up of Wages Boards.

Then came the War, but another railway

strike the year after its cessation heralded a period of considerable industrial unrest in England. In 1926 came the great General Strike (which see) called by the T.U.C. in support of the miners. Industry and transport were brought to a standstill for several days. The General Strike did not prove successful and was called off, though the miners' strike continued. The Government passed legislation prohibiting general strikes and sympathetic strikes. Intimidation was also made an offence (Trade Disputes and Trade Unions Act, 1927).

STRIKE. A term applied by geologists to the line at right angles to the dip of the beds. Horizontal beds with no dip have no strike. The angle of dip and the line of strike are measured by a clinometer and compass. The outcrop of a bed is the same as the strike only when the land surface is horizontal or the strata are vertical. See **DIP**.

STRINDBERG, AUGUST (1849-1912). A famous Swedish writer. In 1878 his first important play, *Master Olaf*, was produced after it had been changed to please the theatre managers, who had refused it six years before. The work was of value because it started a revolt against time-honoured traditions in Swedish literature. The next year appeared his novel *The Red Room*, which revealed his gift for sarcastic expression of opinion and realistic description.

Once started on his literary career, Strindberg worked with superhuman energy, but for two years (1895-1897) was idle because of a mental breakdown. At various times he was a realist, a romanticist, a sceptic, and a mystic. He was also a zealous advocate of the theory that woman is inferior to man, mentally, physically, and morally.

Strindberg's numerous writings, in addition to those named above, include *A Fool's Confession* (autobiographic in character), *The Natives of Hemsö*, a novel of Swedish peasant life; *Fisher Folk*; *Utopias Realized*, a plea for socialism; *Speeches to the Swedish Nation*; and the plays *Gustavus Adolphus*, *The Father*, and *Lucky Pehr*.

STRONGBOW. See **LEINSTER** (History); **PEMBROKE** and **MONTGOMERY**.

STRONTIUM, *stron' shik um*. A pale-yellow metallic element whose compounds occur in small quantities in rocks, soil, and mineral waters. It was first found in the lead mines of Strontian, Argyllshire, whence it derives its name. It is harder than lead; is ductile and malleable, that is, capable of being drawn into a wire and hammered into a sheet; and gives a brilliant crimson flame. Strontium hydroxide is used to extract sugar from molasses in the beet-sugar industry. The nitrate is used in fireworks since it colours a flame crimson. "Red fire" is a

mixture of potassium chlorate, shellac, and strontium nitrate. The chemical symbol for strontium is *Sr*.

STRYCHNINE, *strih' nin*, or *strih' neen*. A bitter, poisonous drug with powerful stimulating properties, obtained from the seeds of the nux vomica and kindred plants. In doses one-sixtieth to one-fifteenth grain, it is prescribed as a tonic, and is given as a stimulant in cases of acute diseases where collapse is imminent, for it increases the flow of digestive juices, directly affects the spinal cord, and indirectly affects the heart and lungs. One grain is usually fatal to man. The symptoms—violent twitching, difficulty in swallowing, and convulsions (which see) when the body is bent backward—appear in about twenty minutes, and death may result in two hours from suffocation or exhaustion. See POISON.

STUART, ARABELLA (1575–1615). The Stuarts of Lennox were of kin to the Royal House of Scotland; Arabella's grandmother had been the daughter of Margaret Tudor, sister to Henry VIII, and her uncle had been Lord Darnley, father of James VI of Scotland. On the death of Queen Elizabeth in 1603 there was a conspiracy to place her on the throne instead of her cousin James. This plot was skilfully confused by Robert Cecil with another to seize the new king, and his enemies, including Sir Walter Raleigh, were successfully implicated. Arabella had not been concerned and continued to live at Court. She was too near the throne to be allowed her choice of husband, so in 1610 she secretly married William Seymour, whose grandfather had been the son of the Protector Somerset and whose grandmother had been Lady Catherine Grey, a descendant of Henry VII. James I thought this marriage a menace to himself and imprisoned them both. They escaped, but she was captured. Seymour fled abroad and made no attempt to aid his wife, who lived for a few miserable years, writing piteous letters to the king.

STUART, CHARLES EDWARD LOUIS PHILIP CASIMIR (1720–1788), *de jure* Charles III, King of Great Britain. From his childhood the "Young Pretender" was an object of romantic interest to English visitors to Rome, an attractive, lively, athletic boy, musical, a good linguist, and a brilliant shot and dancer. An expedition was prevented by storm, but in 1745 he sailed for Scotland. One of his two small ships put back after a fight with an Englishman, and he landed in the Western Highlands with little money or arms and, for army, the followers still famous as the Seven Men of Moidart. As Prince Regent, he proclaimed his father at Glenfinnan on 19th August.

The Prince marched south and occupied Edinburgh, although the Castle held out. At Prestonpans Sir John Cope opposed him, but his men, many of whom were ill-trained recruits, broke and fled before the Highland charge.

Charles held Court for five weeks at Holyrood. This delay allowed more efficient regiments to be moved back from the Continent, but it was essential for him to collect and organize his own forces. His general



PRINCE CHARLES EDWARD STUART
A portrait made in later life
(National Portrait Gallery)

was Lord George Murray, who was now to prove himself a strategical genius, but who was antipathetic to the Prince and his trusted Irish advisers. General Wade was at Newcastle; the Duke of Cumberland in the Midlands. Lord George feinted with some of his mobile troops along the Berwick road until he had drawn Wade, then swung west to march the whole army through Carlisle, which incontinently surrendered. By pressing south he prevented Cumberland, who had to guard London, from attempting to join Wade. Every day Charles marched on foot at the head of his Highlanders. On 20th November, Manchester was taken by an advance guard consisting of a recruiting sergeant, a drummer, and a woman. Cumberland, who lay at Lichfield, moved westwards to Stone to intercept an apparent march on Wales, but Lord George turned eastward to Derby. There was now no appreciable force between Charles and the capital.

At Derby the council of war insisted on

retreat. The English Jacobites had not risen, French help had not come, and their army was under 5000 in all; they cared little for this invasion, for they hoped to see Scotland under a Stuart king separated from Hanoverian England. Charles knew the impossibility of this, but was unable to move them, and on 6th December the retreat began. The fiasco of 1715 and the material prosperity secured by Walpole had weakened the Jacobite cause, but England had no love for the Hanoverians and a lingering affection for the ancient line. Had Charles proclaimed his adoption of Anglicanism, as he was to do five years too late, he would have swept the country. His Highlanders were regarded as savages and his foreign education was suspect, but England was uncertain rather than hostile, and further boldness might have carried the day. There was a strong Jacobite feeling in London, the Duke of Beaufort was on the verge of mounting the white cockade, and a message promising Welsh support arrived at Derby on the day after the army had left.

Lord George skillfully extricated his forces from England, but he had lost the confidence of the Prince. After a futile siege of Stirling, General Hawley was defeated at Falkirk—to the obvious gratification of Sir John Cope—and the Jacobites retired to the Highlands. On 16th April a half-starved, dispirited army, exhausted by an ineffective night manoeuvre, was broken by Cumberland's cannon and superior numbers on Culloden Moor, and there began the series of butcheries so strongly in contrast with the humanity shown on the march to Derby.

Unlike his father, Charles Edward could not bear adversity, and he steadily deteriorated, sharing in the bitter recriminations of the other exiles, quarrelling with the King of France and with his own father and brother, and apparently taking to hard drinking. He succeeded his father in 1766 as Charles III. In 1772 he married Princess Louise of Stolberg, and their quarrels caused further scandal. The most remarkable incident of his later years is a suggestion in 1774 that he should be accepted as king by the American colonists.

STUART, HENRY BENEDICT MARIA CLEMENT (1725-1807), *de jure* Henry IX, King of Great Britain. The younger son of James III, or the Old Pretender, was created Duke of York. Gentle, quiet, and scholarly, he was devoted to his more brilliant and wayward elder brother, for whom he tried to raise French aid in 1745. Convinced of the failure of the cause, in 1747 he accepted a cardinal's hat, becoming in 1761 Bishop of Frascati; he is sometimes referred to as the Cardinal of York. This step estranged

him from his brother, who feared the effect on English opinion. They were reconciled after the father's death. On the death of Charles in 1788, the Cardinal-Duke assumed the style of Henry IX of Great Britain and lived in royal state, although he seems to have made no active attempt to regain his rights. He was reduced to poverty by the French Revolution, by the confusion in Spain, and by the French invasion of Italy, this last driving him from Frascati in 1798. He was later allowed to return and received a pension from the British Government; in settling this payment, both Henry IX and George III showed admirable dignity and good feeling. He acknowledged as his heir the Sardinian king, descendant of Henrietta, daughter to Charles I, and ancestor to the present Rupert of Bavaria.

STUART, JAMES EDWARD FRANCIS (1688-1766), *de jure* James III of England and VIII of Scotland. The birth of his son, on 10th June, 1688, proved disastrous to James II, for the knowledge that the new heir would be brought up as a Roman Catholic spurred the Protestant leaders to desperate measures, which were rendered successful by the indecision of the king. The story was spread that the young Prince was in reality a commoner's child, smuggled into the palace in a warming-pan. Within a few months of his birth, his mother, Mary of Modena, fled with him to France, and his long exile began.

The boy was brought up in the dignified quiet of St. Germain, provided by the generosity of Louis XIV. In 1696 an offer to accept him as heir, in return for a present acknowledgment of William III's rule, was refused by James II, whose own death came in 1701. His thirteen-year-old son was proclaimed by Louis as King of Great Britain, an act which infuriated the English. One great weakness of the Jacobite cause was its association in men's minds with France, although French policy was to harass the British Government rather than to effect another Restoration.

Until he was 18, the affairs of James were ordered, discreetly enough, by his mother, who had wisely refused to alienate England by committing him to a suggested Scottish rising. He was nicknamed "Le Prétendant" or Claimant; this last was wilfully mis-translated by the Whigs as "The Pretender," to which an explanatory "Old" was added in later years, when his son had acquired fame and he had himself acquired another nickname—"Old Mr. Misfortunate."

Throughout his life, James showed the qualities most desirable in a sovereign prince. He was compassionate, honourable and courageous, gifted with wisdom and

prudence, shrewd in his reading of men. He lacked, however, the audacious charm which carries through a great venture, the gift of dramatically effective word and deed. He commanded respect, but, unlike "The Black Boy" hiding in Boscobel oak or the Young Chevalier in the heather, he made little



PRINCE JAMES EDWARD FRANCIS STUART
(National Portrait Gallery)

personal appeal. His sincerity was a serious political handicap. If he had professed Protestantism he would undoubtedly have been received as Anne's successor, but his promise of religious toleration was neither credited nor admired.

In 1708 he sailed with a French force to Scotland to take advantage of the fury caused by the Act of Union, but the timidity of the French commander prevented him from landing to almost certain success. His conduct with the French cavalry at Oudenarde and Malplaquet won him the admiration of the English army, whose outposts he sometimes visited. In 1714 the Queen died, and the Whigs proclaimed the Elector as king.

Jacobite feeling grew so strong that simultaneous risings in England and Scotland were being planned, when in 1715 the Earl of Mar, "Bobbing John," suddenly proclaimed James in the Highlands. Nobody was ready, and the Government was able to crush the English insurgents at Oxford, Bath, and elsewhere in the south. The northern Jacobites, under Forster and Lord Derwent-

water, were forced to surrender at Preston. Meanwhile, Mar, having first blundered by precipitancy, made matters worse by hesitation, finally retreating from Argyll's inferior forces after an indecisive battle at Sheriffmuir. The French Regent, Orleans, not desiring war with England, refused to James the services of the Duke of Berwick, a brilliant soldier and a Marshal of France. James, after vainly striving for Continental aid, landed in the Highlands, to find that Mar's incompetence had dispirited his followers.

English pressure on France led to the expulsion of James, who settled in Rome. In 1717 he narrowly failed to secure the aid of Charles XII of Sweden. In 1719 a Spanish fleet, sent to land men and arms on his behalf, was scattered by bad weather. Later in that year he married Clementina, granddaughter of John Sobieski, the great soldier; she had been romantically snatched from Imperialist guards by a handful of Irish Jacobites, led by the Chevalier Wogan. After the Forty-five, James was convinced that all was over.

STUART, *HOUSE OF* (earlier Scottish members). See STEWART, FAMILY OF.

STUCCO, *stuk'ō*. Strictly, any kind of plaster used for coating walls, including fine plasters for internal decoration and mouldings; in current usage, a weather-resisting calcareous plaster applied to outside walls as a protective to brickwork and to present a finished appearance. For both the latter purposes stucco is especially favoured in seaside districts.

STURGEON, *stur'jū*. The common name of a family of large fish inhabiting fresh waters and seas of the North Temperate



Zone. The flesh is generally smoked for table use; the eggs are used in the preparation of caviar. From the bladder of the Russian sturgeon a superior quality of isinglass is obtained. These fish have slender, elongated bodies, covered with rows of bony plates. There is a long snout, beneath which is a small, toothless mouth with thick,

sucking lips. There are four barbels in front of the mouth. A single dorsal fin grows on the back, and the tail is forked, the lower lobe usually being shorter than the upper. Most species migrate from salt water into streams in the spawning season, though some live permanently in fresh waters. One of the best-known species is the *common sturgeon*, found in European waters, especially at the mouth of the Danube, and along the American coast. The largest specimens are 10 ft long and weigh as much as 500 lb. Other species include the great Russian *beluga*, which sometimes reaches a weight of 3000 lb. Another Russian sturgeon, the small *sterlet*, is also the source of caviar.

Scientific Names. The common sturgeon is a species *Sturio* of the genus *Acipenser*. The beluga is *A. huso*; the sterlet, *A. ruthenus*.

STUTTERING. See STAMMERING.

STUTTGART. *stoot' garl*. See GERMANY.

STY OR STYE. An inflamed swelling on the edge of the eyelid, which develops into a tiny abscess. This usually breaks of itself, but help may sometimes be given by pricking it with a sharp sterilized needle. The eye should be bathed frequently in a lotion of boracic acid and warm water.

STYLE. See FLOWER.

STYLUS. See PEN; CUNEIFORM INSCRIPTIONS.

STYPTIC, *stip' tik*. See FIRST AID.

STYRIA, *stir'ia*. A province of the Austro-Hungarian Monarchy before 1918, and now a division of Austria (which see).

STYX, *stiks*. In Greek and Roman mythology, the dreary and pestilential river that flowed round the underworld, the abode of the dead. Across it the departed spirits were rowed by the ferryman Charon to the realms of Death, who assigned them either to Elysium (Elysian Fields) or to the grim regions of Tartarus.

SUBCLAVIAN, *sub klav' vian*, **ARTERY AND VEIN.** See BLOOD, colour plate.

SUBCONSCIOUS. See UNCONSCIOUS.

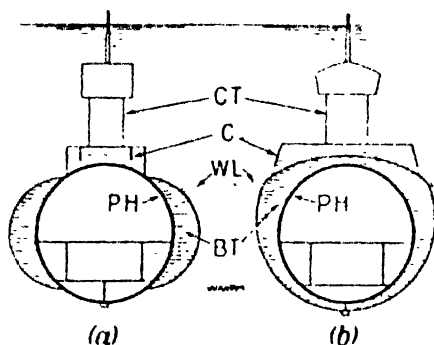
SUBJUNCTIVE. See MOOD.

SUBLIMATION, *sub lim ay' sh'n*. In the psychological meaning of the word, this usually implies the deflection of the energy of the sex-instinct to non-sexual and useful ends. Thus a man may become wedded to a scheme of reform or devoted to his work, putting into these activities much of the energy that others expend in their love-relationships. Sublimation occurs to a greater or lesser extent in every one.

By some psychologists sublimation is used in a broader sense for the deflection of the energy of any instinct. Thus many sports and games could be considered as channels for the sublimation of the aggressive instinct. See INSTINCT.

SUBMARINE, *sub ma reen'*. A vessel designed to travel under water. Strictly speaking, the war vessels so designated are "submersibles"; that is, they navigate normally on the surface, but can be submerged for the purpose of concealment, as when patrolling or when delivering or evading an attack. The submarine is predominantly a vessel of war, although during the World War the Germans built cargo-carrying submarines as a means of combating the allied blockade.

History of Submarines. The idea of a vessel capable of navigating beneath the surface of the sea is a very old one. It is recorded that in 1625 Cornelius van Drebbel, a Dutchman, devised a submarine which was



FORMS OF SUBMARINE HULL: (a) SINGLE HULL, SADDLE-TANK TYPE, (b) DOUBLE HULL

BT = Main ballast tank

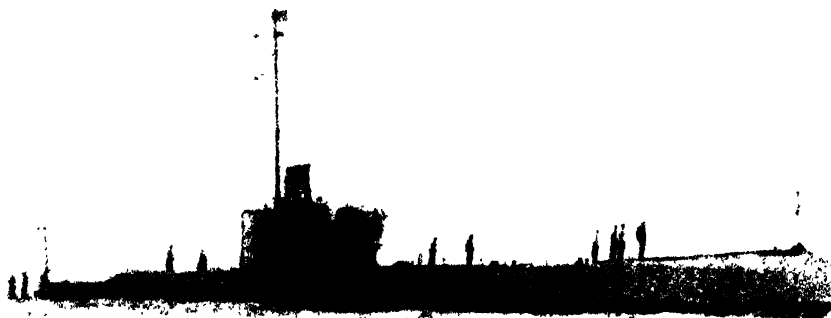
C = Casing

CT = Conning tower

PH = Pressure hull

WL = Water line when navigating on the surface

demonstrated in the Thames. The first submarine used in war was invented by David Bushnell, and in her, during the War of American Independence, he made an abortive attempt to sink the British frigate *Eagle*. In 1801 Robert Fulton built a submarine which he offered first to the French, and then to the British Admiralty. It was refused, although Pitt, the Prime Minister, favoured its adoption. Hearing of this, shrewd old Admiral Lord St. Vincent observed that "Mr. Pitt is the greatest fool that ever existed, to encourage a mode of war which they who commanded the sea did not want, and which if successful would deprive them of it." The prescience of this observation was to be most terribly demonstrated a hundred and eleven years later. During the American Civil War of 1861-1865 the Confederates contrived some embryo submarines called *Dauids*. One of these succeeded in sinking the Federal vessel *Housatonic* in Charleston Harbour, but was herself dragged to the bottom by her victim.



BRITISH P. CLASS SUBMARINE
A typical vessel of the "patrol" type.
Photo: Gieses

The early boats were all driven by hand power, and to this handicap was added the lack of a suitable weapon. The development of the steam engine—later to be displaced by the internal combustion engine—and of the electric motor and storage battery overcame the powering problem; and the invention of the locomotive torpedo furnished the weapon. France was the first Power to take up submarines seriously, followed by America, Italy, and Great Britain. Germany did not start a serious programme of construction until 1906.

Construction and Equipment.

Essentially a submarine consists of an approximately spindle-shaped pressure hull made of stout plating supported by strong ribs to withstand the great pressure of the water when submerged. Integral with the hull are a number of *main ballast tanks* fitted with *Kingslon valves* to admit water from the sea and *vent valves* to allow their air content to escape as the water enters. The water can be expelled again by admitting compressed air to the tanks or, in smaller quantities, by a pump. At the extremities of the vessel are *trimming tanks*. The two most common forms of submarine hull construction are illustrated in the diagram opposite.

Rising from the midship part of the pressure hull is the *conning tower*, which carries

at its summit the navigating bridge; and running along the upper part of the hull and surrounding the conning tower is a superstructure or *casing* which forms a deck on which the crew take their stand when manning the gun or when working their vessel into or out of harbour. Hull, casing, and conning tower are all carefully streamlined.

For surface propulsion, Diesel engines are used, burning heavy oil. Electric motors,

taking their current from a large storage battery, provide the motive power when running submerged. Considerations of weight set a limit to the capacity of the battery which can be installed, and consequently to the vessel's

performance submerged. If run at high speed she will exhaust her battery in a very few hours; but if her speed is kept low, she can remain under for the best part of a day. To re-charge the battery it is necessary to rise to the surface. A modern submarine of the "patrol" type is capable of 13½–17½ knots on the surface and 9–10 knots submerged; while vessels of the "cruiser" type can do as much as 22 knots on the surface.

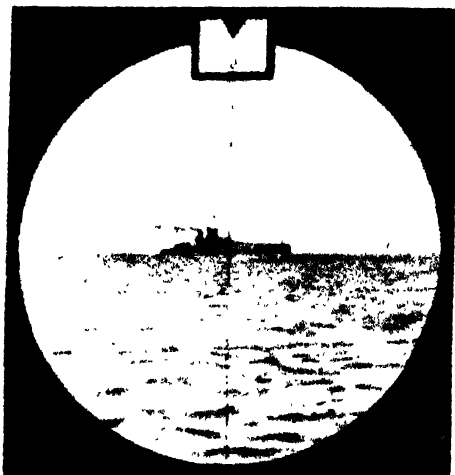
Steering for direction is accomplished by means of a rudder of the usual form. Horizontal rudders, termed *hydroplanes*, are fitted



AN EARLY UNDER-WATER VESSEL
The first submersible ship built by Holland.
Photo: Brown Bros.

forward and aft to enable the vessel to be steered for depth.

To enable observation to be maintained while the submarine is running submerged, two or even three *periscopes* are provided. The periscope consists of a long tube about 6 in. in diameter, tapering to 3 in. at its upper extremity. At the top is a prism



BATTLESHIP AS SEEN THROUGH THE PERISCOPE
OF A SUBMARINE

Photo: Barr & Stroud

which, through a system of lenses, reflects the scene before it down to an eyepiece at the lower end, which is in the *control room*, while the top of the instrument projects above the conning tower. Handles are fitted to enable the periscope to be trained in the required direction.

When the submarine is running so that the top of the fully extended periscope is just above the surface, she is said to be at *periscope depth*: should she dive any deeper she becomes blind, and then has to depend on aural instruments (*hydrophones*) for warning of danger.

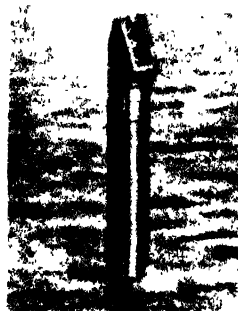
The torpedo is the principal weapon of the submarine. The latest British vessels carry six bow torpedo-tubes mounted so as to fire right ahead, and certain types have also two stern tubes. Most foreign vessels are similarly armed. The gun is a secondary weapon, as a submarine will not ordinarily choose to engage in a gun action, although circumstances may compel her to do so. During the World War the German submarines made extensive use of their guns against merchant vessels, thus conserving their comparatively limited stock of torpedoes. Modern submarines usually mount a single gun of 4 in. to 5 in. calibre, although one or two "freak"

types carry heavier weapons. Certain classes of submarines are equipped to act as minelayers.

In addition to the armament and propelling machinery, space has to be found within the hull of a submarine for a quantity of other equipment such as the gyroscopic compass and other navigational appliances, a powerful wireless installation, air-compressors with their batteries of reservoirs, pumps for expelling water from the ballast tanks, the electric motors for working the rudder and hydroplanes, and much other apparatus. Stowage must be provided for oil fuel for the engines—room is frequently found for this in some of the ballast tanks—for spare torpedoes and ammunition for the guns, for food and fresh water. Last, but not least, there is the accommodation for the crew, which in a large cruiser type submarine may amount to five officers and upwards of 70 men.

Diving. To dive a submarine, water is admitted to the ballast tanks until the vessel's reserve of buoyancy is all but destroyed. (If necessary, the *trim*, or fore-and-aft level, is adjusted by varying the amount of water in the trimming tanks.) The Diesel engines are unclutched and the electric motors started. With the motors going ahead, the hydroplanes are inclined downwards so that they force the boat under. Once the desired depth is reached, the hydroplanes are manipulated to keep the vessel at this depth and in horizontal trim. To bring her to the surface, the procedure is reversed.

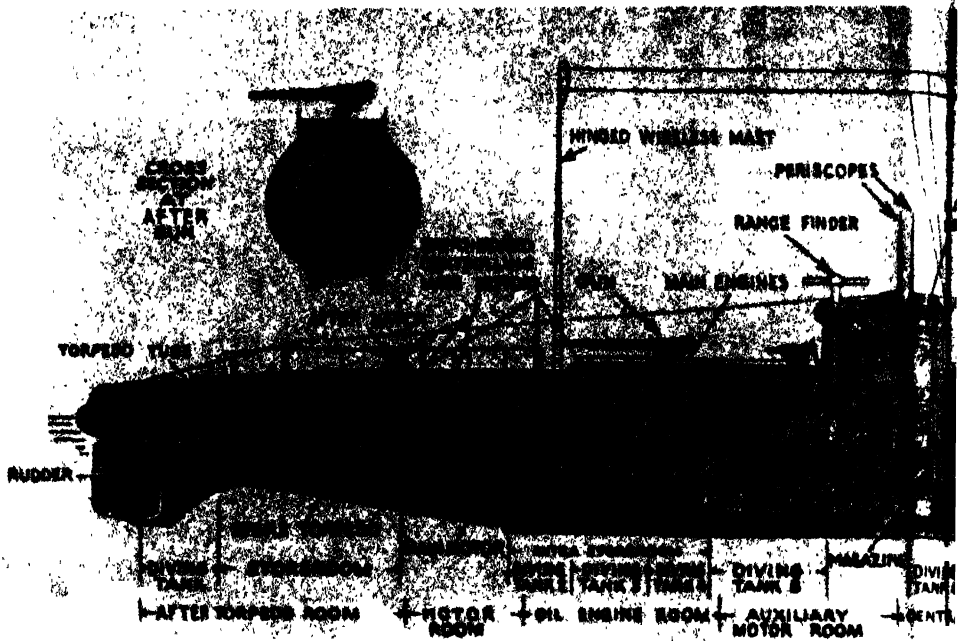
Attacking. Should the submarine sight her target while still on the surface, she will probably delay diving as long as possible in order to retain the better conditions for observation and also to keep the advantage of her superior surface speed when manoeuvring to get into position for her shot. When the risk of being sighted becomes too great—and this may occur early if the ship attacked is escorted by aircraft—she will dive and continue to work into position, keeping observation of her target through the periscope. The nearer she approaches, the less frequently will she expose her periscope and, for shorter intervals, to minimize



PERISCOPE OF A SUBMERGED
SUBMARINE

Photo: Barr & Stroud

THE INTERNAL ARRANGEMENT

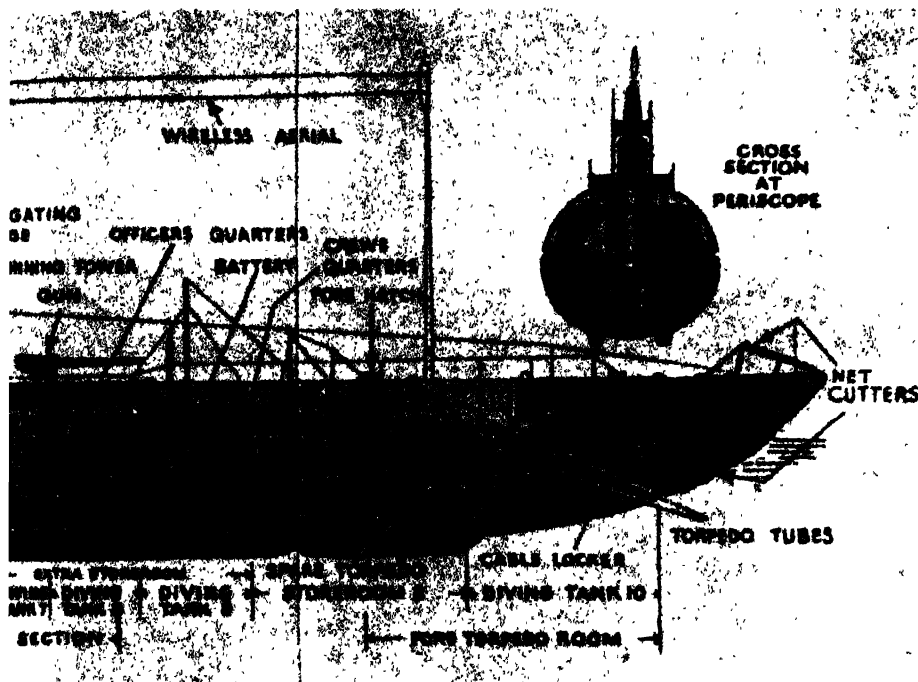


The illustration shows a section of the later types of German submarine placed in service towards the

Taking first the external features: At the extreme bows (the right-hand end of the figure) can be seen the *net-cutter*, designed to assist the vessel to force her way through an obstruction. The cutter is reinforced by *jumping wires*, which extend from just abaft the cutter to the top of the conning tower and thence down to the stern. These serve to carry any obstruction which may be fouled clear of the tower, guns, and other deck fittings. The hinged wireless masts are arranged so that they can be erected for the purpose of signalling when on the surface, and stowed down flush with the deck preparatory to diving. The fore and after hatches, which normally are only used in harbour, besides providing for the passage of personnel to and from the interior of the vessel, also enable torpedoes, stores, and so

on to be "struck down" into the boat. At the summit of the conning tower is the navigating bridge, to which access is obtained through a hatch leading into the tower. The two guns remain always in the position shown. No provision is made to protect them from the water when diving, and the only serious drawback to the arrangement is that they disturb the streamlining of the hull and so reduce the speed. At sea, passage to and from the interior is made *via* the conning tower hatch; except that for the more rapid manning of the guns in action, special hatches are used which are situated close to them. Inside the vessel, at the extreme bows, are the four forward torpedo tubes, two of which can be seen. A torpedo is normally kept loaded into each tube, while the spares are stowed in the torpedo room immediately

MENT OF A SUBMARINE

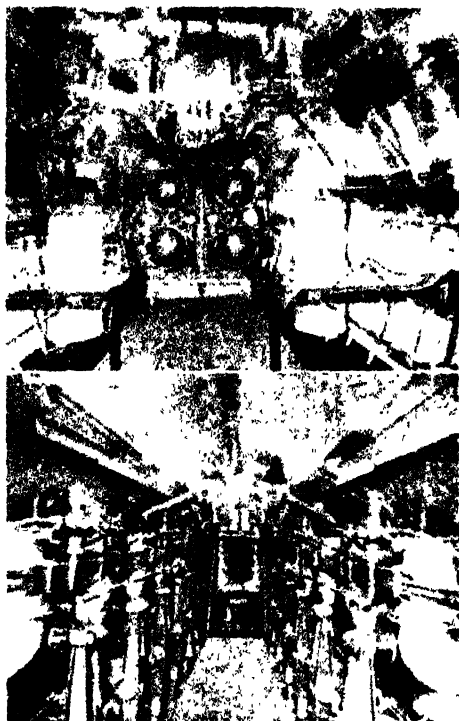


onal view of one of
ibmarine which was
ose of the World War

t the tubes. (One of these torpedoes is
rrible housed beneath the floor boards.)
torpedo room also furnishes space in
h testing can be carried out. The tor-
room leads into the crew's quarters
thence again into the officers' quarters.
ath these spaces are situated the electric
ries. Immediately adjacent to the
ers' quarters is the *control room*, in which
oncentrated the various apparatus for
gating and controlling the vessel. Open-
off the control room are such compart-
ts as the wireless room, while below it is
auxiliary motor room, which houses such
hinery as the air-compressors, pumps,
so on. From the control room to the
are situate in succession the oil engine
n, with its two Diesel engines, which
e to propel the vessel while she is on the

surface; the main motor room, with its
twin electric motors available at need to
drive the boat when she is submerged or to
recharge the batteries when she is on the
surface; the after torpedo room with its
spare torpedoes and the switchboards for
controlling the main motors; and last of all
the two after torpedo tubes. The vertical
rudder for steering the vessel can be seen;
the hydroplanes which regulate the depth
are not shown, but the mechanism for oper-
ating the foremost pair can just be discerned
above the forward torpedo tubes; while
that for operating the after pair is similarly
situated just above the after tubes. The
ballast tanks, which are formed by the spaces
between the "pressure" and outer hulls,
run for the greater part of the length of the
boat, and are shown in the sectional views.

the danger of the tell-tale "feather" betraying her presence. She will endeavour to reach a position within half a mile of her enemy and broad on the bow before firing, as this offers the most favourable chances for a hit, and then, according to circumstances, will discharge one or more torpedoes. If the vessel attacked is escorted by anti-submarine vessels or aircraft, the submarine will then



INTERIOR OF A SUBMARINE
Torpedo room (above) and engine room.
Photos: U. & U.

"go deep" to avoid the counter-attack and stay down until she can escape.

Anti-submarine Weapons. The part played by submarines during the World War gave a tremendous impetus to the development of anti-submarine measures. Of the special weapons evolved, most important was the *depth-charge*—a kind of small mine, projected from a vessel and exploding at predetermined depth; there were also *explosive paravanes* (see PARAVANE) and mined nets which first enveloped and then destroyed a submarine which tried to break through them. Existing weapons such as the *mine* (which see) were also adapted to the purpose: for example, deep minefields were laid to catch submarines which tried to evade the

ordinary shallow fields laid for surface vessels by diving under them. Special vessels, such as the American *submarine-chasers*, were constructed for anti-submarine work, and Britain even built a class of submarine—the "R" class—which were virtually "submarine destroyers," and possessed the unusual attribute of being faster submerged than they were on the surface. Destroyers (which see) were particularly useful against submarines, and when employed on convoy work were often given a special anti-submarine armament; and sloops (which see) performed similar work. (See also Q-SHIPS.) During the World War, 24 per cent¹ of the German submarine losses were attributed to mines, 21 per cent to depth-charge attacks, 11 per cent to torpedoes fired by Allied submarines, 9 per cent to gunfire, and the remainder to other causes.

SUBMERGED FORESTS. In many places round the shores of Britain, roots and stumps of trees, together with a peaty mass, are exposed at low tides. These are the remains of ancient forests of glacial or post-glacial age, which were preserved under special conditions as the land slowly sank beneath the sea. They are seen in Mount's Bay, Carmarthen Bay, at Poole, Torbay, at the mouth of the Humber, and other sheltered places. Weapons of stone and bronze have been found in the soil of such forests.

SUBPOENA, sub pe' na. Writ by which a person is summoned to give evidence in a court of law. It is called a *subpoena* ("under a penalty,") because a witness who has been subpoenaed and fails to attend the court without sufficient excuse is guilty of a contempt of court, punishable by fine or imprisonment. A subpoena is issued by the officials of the court on the application of the party proposing to call the witness.

A special kind of subpoena is a *subpoena duces tecum* ("under a penalty you shall bring with you"). This is a summons to the witness not only to attend the court but also to bring with him certain documents mentioned in the subpoena, to be used as evidence at the trial. See WRIT.

SUBSIDENCE. See GEOLOGY.

SUBSIDY. A grant made by the State, usually to stimulate a particular industry. There are records of grants to the textile industry in the Middle Ages, and various grants in the seventeenth century to agriculture (corn) and shipping were precedents for modern subsidies on the production of wheat and beet-sugar, and shipping. Civil aviation in England is subsidized.

SUCCESSION. See ACCESSION.

¹ Based on figures given in *The German Submarine War, 1914-1918* (Gibson and Prendergast), published by Constable.

SUCCESSION WARS. Those wars that were caused by rival claims to the inheritance of a throne.

The War of the Spanish Succession. This struggle began in 1701 and lasted until 1714. Charles II, king of Spain, was childless, and the question as to who should be his successor was of vital importance to Europe. Family alliances among related sovereigns were very common in those days, and if a foreign-born prince were to ascend the throne of Spain, an entirely new alignment of the European powers would be the result. The laws governing the succession were so involved, and the claims of the different heirs were so conflicting, that it is almost impossible to know who rightfully should have worn the Spanish crown. The valid claimants were soon narrowed down to three: the French prince Philip, Duke of Anjou and grandson of Louis XIV; Joseph Ferdinand, the young electoral prince of Bavaria; and the Archduke Charles of Austria, son of Emperor Leopold I.

The leading powers of Europe joined in a treaty in 1698, according to which Joseph Ferdinand was to become king of Spain, and France and Austria were to be compensated with territories from the extensive Spanish possessions in Italy and other parts of Europe. Unfortunately, the electoral prince died, and the matter was in confusion again. The issue now lay between the Hapsburg and the Bourbon dynasties. A second treaty, in 1699, arranged that the Archduke Charles was to receive the Spanish crown, and the French royal family should be indemnified by additional Spanish territory. Everything seemed to be settled in order to guarantee the peace of Europe, when King Charles II died in Spain on 1st November, 1700, leaving a will by which he bequeathed his crown to the French prince, Philip of Anjou. Louis XIV then broke his solemn word, given when he signed the treaty, and proclaimed his grandson to be king of Spain. Louis further angered the English by recognizing the son of the dethroned James II as the rightful king of England and by taking steps to secure a French monopoly of the trade of Spanish America.

Almost immediately, the *Grand Alliance* was formed between England, the Holy Roman Empire, the Netherlands, Prussia, and Hesse, in order to prevent Philip of Anjou from becoming king of Spain, and to aid the Archduke Charles to ascend that throne in his place. The allied forces were placed under the command of two great generals, the English Duke of Marlborough and Prince Eugene of Savoy. Under the leadership of the former the French were defeated decisively, during the years 1704 to

1709, in the battles of Blenheim, Ramillies, Oudenarde, and Malplaquet. The fighting was for the most part in Germany and the Netherlands. The only outstanding naval success was the capture of Gibraltar by a British fleet in 1704. The campaigns ended with the establishment of Philip as king, and the extension of his rule in Spain.

The allies possibly might have overthrown Louis XIV and seized Paris had not dissensions broken out among them; in addition, party politics in England caused the Tory government to desire peace in order to discredit the victorious Marlborough, who was a prominent Whig. Moreover the Archduke Charles had succeeded to the Austrian dominions as Charles VI, and the union of Austria and Spain would have equally disturbed the balance of power in Europe. Louis XIV, although badly defeated and with his country exhausted, took heart, and by skilful diplomacy brought about the *Peace of Utrecht* in 1713, by which he obtained fairly favourable terms, including the recognition of his grandson as king of Spain. France and Spain never were united, however. Charles VI refused to sign the Treaty of Utrecht and did not make peace until a year later, when he found it necessary to give way and sign the Treaty of Rastadt, upon almost the identical terms of the Peace of Utrecht.

The War of the Polish Succession, fought during the years 1733 to 1735, was caused by the election by Polish nobles of Stanislaus Leszczynska, father-in-law of Louis XV of France, as king of Poland. Russia and Saxony forced the Poles to accept the Elector Augustus of Saxony as king, and war followed. France failed to keep Stanislaus on the Polish throne, but he was given the duchy of Lorraine, which reverted to the French crown at his death in 1766.

The War of the Austrian Succession began in 1740 and lasted until 1748. It was caused by the death, in the former year, of Emperor Charles VI, who left as heiress to his dominions a daughter, the famous Maria Theresa. The great powers of Europe had guaranteed, by the Pragmatic Sanction, her succession to the Austrian dominions, but they broke their pledged word and attempted to despoil the young princess of her inheritance.

The first to attack Maria Theresa was Frederick the Great, king of Prussia, who conquered the province of Silesia. During the next year, 1741, he strengthened his hold upon the territory by an overwhelming victory at Mollwitz. France and Spain and the two strong German states of Bavaria and Saxony joined Prussia, and for a time Maria Theresa was threatened with the loss of her dominions. The Elector Charles of Bavaria

was chosen emperor by support of the allies.

However, Maria Theresa saved her crown and most of her dominions by her own indomitable courage and vigorous leadership. She was aided by an alliance with the great maritime powers, England and Holland, which crushed the power of France at sea. Maria Theresa soon drove out the new emperor, Charles VII, even from his Bavarian dominions, and he died in 1745. She then received the title of empress through the election of her husband, Francis of Lorraine, as Emperor Francis I.

Maria Theresa, after making two separate treaties of peace with Frederick the Great, finally separated this most dangerous antagonist from the alliance with her other enemies, but accomplished it only at the price of the cession to him of Silesia. Also, with the aid of the armies of her English and Dutch allies, she carried on the war against France and Spain with great vigour and success. However, her successful career was checked by the brilliant victories of the French army in the Austrian Netherlands, and she was induced by the attitude of her allies, England and Holland, to agree to make peace.

The Treaty of Aix-la-Chapelle, which was signed in 1748, finally ended the war. The empress at once began the negotiations that led to the realignment of the European Powers, and to her final attempt to destroy Frederick the Great and regain Silesia, through a later conflict that was to be known as the Seven Years War (which see).

The War of the Bavarian Succession was a short quarrel, during the years 1778 and 1779, over the succession to the throne of Bavaria and the disposition of part of the Bavarian territory. The dispute was between Prussia and Austria. The Elector Maximilian Joseph died in 1777, leaving no direct heirs. Austria then attempted to dominate the affairs of Bavaria and to dictate the succession, thus arousing the jealousy of the ever-watchful king of Prussia, Frederick the Great. Both Prussia and Austria invaded Bavaria with their armies, and a bloody war seemed inevitable, but no battle was fought, and the dispute finally was compromised. The Treaty of Teschen was signed in 1779, and both Austria and Prussia were satisfied by certain territorial gains.

SUCKLING, SIR JOHN (1609-1642). An English lyrical poet of the metaphysical group. He spent immense sums of money for Charles I in the conflict with Cromwell. Being accused of taking part in the plot to release Strafford from the Tower, he fled to the Continent. Poems such as *Why So Pale and Wan, Fond Lover*; *A Ballad Upon a Wedding*; and *I Prithee Send Me Back My*

Heart have earned Suckling a lasting reputation.

SUCRE, *su' kray*. See BOLIVIA.

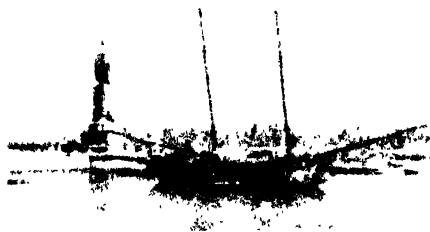
SUDAN'. A general name for that part of Africa which lies south of the Sahara and north of the equatorial forests and extends from the Atlantic to Ethiopia. Nowadays however, it is generally used in a narrower political sense to indicate either the Anglo-Egyptian Sudan in the east, or the French Sudan in the west. See ANGLO-EGYPTIAN SUDAN; FRENCH SUDAN.

SUDERMANN, *su' der mahn*, HERMANN (1857-1928). A dramatist and novelist, born at Matzicken, Prussia, and one of the principal satirists of the age. European civilization with its accompaniment of convention and restraint he bitterly attacked, and urged the pursuit of happiness unimpeded by artificial canons. His novels include *Es War*, and his plays *The End of Sodom*, *Magda*, and *The German Fate*.

SUEDE, *swayd*. See GLOVE.

SUEZ. See EGYPT.

SUEZ CANAL. A ship canal extending in a north-and-south direction across the Isthmus of Suez in Egypt, connecting the Mediterranean and Red Seas. From Port Said, on the Mediterranean, it extends to Suez, on the Gulf of Suez, a distance of 103



SUEZ CANAL ENTRANCE BREAKWATER

The statue is of de Lesseps

Photo Fox

miles, 21 miles of which consist of small lakes. Its construction, shortening the route between England and India by 6000 miles, restored the Mediterranean to its ancient place as the most important highway of European and Asiatic trade.

The Suez Canal has no locks, because there is no important difference between the levels of the two connected seas. As it was originally built, it was 26 ft. deep and 72 ft. wide at the bottom, but the canal has twice been widened and deepened, and now has a minimum depth of 33 ft. and a minimum width of 108 ft.

History. There is evidence that a canal was built, connecting the Nile River and the

Red Sea, many centuries before Christ, and the idea of joining the Red Sea and the Mediterranean may be traced to the eighth century A.D. Napoleon appreciated the advantages of a waterway across the Isthmus of Suez when he visited Egypt in 1789, and ordered surveys to be made. However, it was left to Ferdinand de Lesseps, a French diplomat and engineer, to carry out the scheme. Near the close of 1854, de Lesseps

forces on both sides of the canal, allowing only Allied and neutral shipping to pass.

SUFFOLK. The most easterly coastal county of England, with an area of 948,269 acres and a population of 401,114 in 1931.

General Physical Features. In the west is a small portion of completely level land—part of the great Fen area of Huntingdon and Ely. In the north-east, Suffolk shares with its neighbour Norfolk the distinction of the Broad. In the north-west it includes nearly half of Breckland, whilst in the south the Valleys of the Stour and Orwell are respectively associated with the paintings of Constable and Gainsborough. A ridge of high ground stretches from north-east to south-west—a district which is frequently referred to as High Suffolk. The remainder of the county is uniform but distinctive, consisting for the most part of highly cultivated fields, considerable belts of woodland, and all the characteristic beauty of a well-watered undulating plain.

The most impressive scenery is that of Breckland. Much of this expanse of primeval heath has been reclaimed during the past century, but there are still wide expanses of deserted heather country reaching a height of about 200 ft. South of this district, on the chalk ridge, is some of the highest ground in the county, exceeding 400 ft in places.

The coast is singularly diversified, and in the southern part broken by a number of broad estuaries, notably the Stour, the Orwell and the Deben. This section is sandy, with heathland. Farther north, low cliffs come down to the sea.

History. At the time of the Roman occupation the whole area fell within the boundaries of the Iceni, a tribe of which Boadicea was queen. Tradition assigns their subjection to the Roman Aulus Plautius. Roman stations and traces of many Roman villas have been discovered. The Dark Age of Saxon invasion is no less obscure in Suffolk than elsewhere. The county became part of the Kingdom of East Anglia. In a long line of kings the name of Sigebert stands out as that of the first monarch to establish the worship of Christianity in the east, and it is recorded that the episcopal See of East Anglia was founded at Dunwich in 632 by Felix of Burgundy at the invitation of the king. Danish invasions occurred from the eighth century onwards.

The Norman Conquest was accomplished without serious resistance in the west, where a Norman abbot ruled already, while the men of the eastern town of Ipswich had fallen in great numbers at Hastings under Gurth, their earl. The whole county was securely held with the help of six castles, of which fragments remain. In the twelfth



NATIVE CRAFT ON THE SUEZ CANAL
Photo. Cherry Kearton

succeeded in obtaining permission from the viceroy of Egypt, and within the next five years worked to overcome various diplomatic, political, and economic obstacles which were set in his way. An International Consultative Commission met in 1855 to discuss the plans and decide the route, and by 1858 an international company was organized. The construction work was begun 25th April, 1859, and ten years later, on 9th November, 1869, the canal was opened.

Britain took no part in the building, but later Lord Beaconsfield secured a seven-sixteenth interest for Britain by the purchase of shares from the Khedive. The management of the Suez Canal is directed by an international committee, on which there are ten British members, twenty French, and one Dutch.

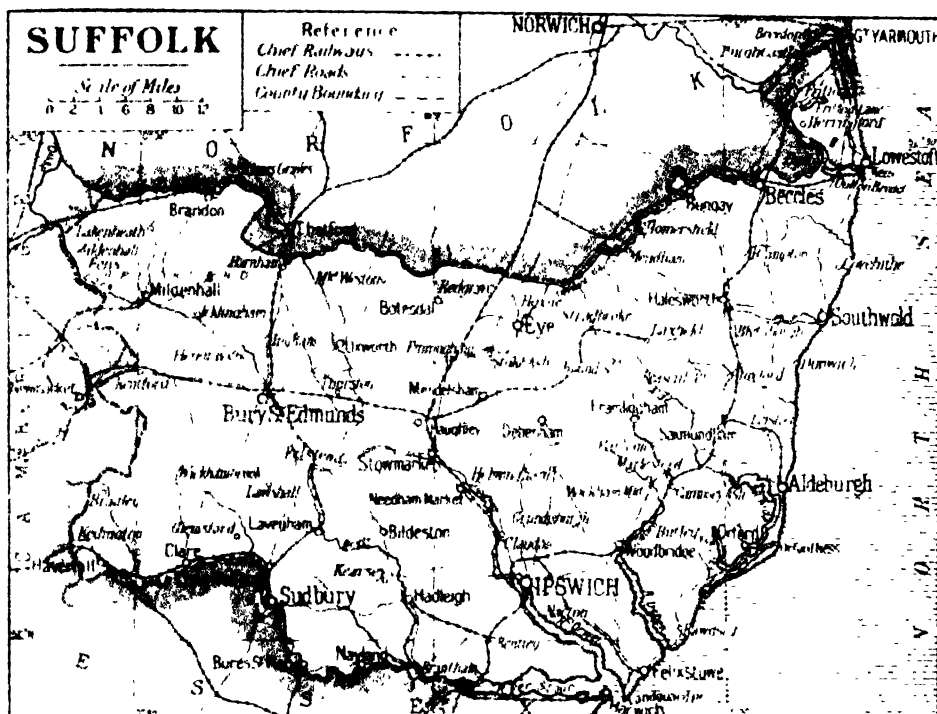
By an international convention of 1888, universally agreed to in 1904, the canal is always open on equal terms to the ships of all nations, both in peace and in war. In 1914, Great Britain ignored certain stipulations of the treaty of 1888, and put armed

century the notorious Hugh Bigod sided with the armies of the Earl of Leicester against the king, and, as a result, the castles of Framlingham and Bungay were partially razed.

In common with the whole of south-east England, Suffolk was a centre of the weaving industry. Kersey and Lavenham were two of the principal centres of this industry. A further fact which contributed to Suffolk's

The railways are operated by the L.N.E.R. exclusively. A main line serves Ipswich and Lowestoft and intermediate stations, whilst a further important line from London connects Ipswich and Norwich.

Agriculture and Industries. Agriculture has always been and still remains the occupation employing the greatest number of people. With reclamation of parts of the sandy ground in the north-west and along



medieval wealth was the number of pilgrims who visited the shrine of Saint Edmund at Bury. In fact Bury St. Edmunds became a source of wealth in Suffolk comparable with Canterbury in Kent.

Neither the Wars of the Roses nor the Great Civil War had an important bearing on this county's history. Its story has been, on the whole, that of a successful agricultural county, the prosperity of which has declined somewhat owing to the loss of the woollen industry.

The county returns six members to Parliament representing the Ipswich Division, the Eye Division, the Lowestoft Division, the Woodbridge Division, the Bury St. Edmunds Division, and the Sudbury Division.

Communications. Main roads are good, particularly those which radiate from Ipswich. All villages are easily accessible.

the coast, the whole area is productive, and though the greater portion is pasture land, many thousands of acres are intensively cultivated. Suffolk is one of the most successful wheat-raising districts of England, and barley occupies a large acreage. In addition, a small quantity of rye is raised, and market-gardening is well represented, particularly in the neighbourhood of Lowestoft, Ipswich and Bury St. Edmunds. In the pasture lands, cattle, sheep, pigs, and horses are all bred. In connection with the former, much dairy-farming is carried on, and the Suffolk Punch is a celebrated breed of draught horse.

Among extant industries engineering is the most important. In particular, the manufacture of agricultural implements is carried on at Ipswich and a number of other places. The fishing industry at Lowestoft

is still of prime importance, and employs a large number of people from outside the county. The principal manufacturing towns are Ipswich and Bury (both of which see). Neither the former woollen industries of Ipswich, Lavenham and elsewhere, nor the more recent cloth manufacture of Haverhill survive.

Antiquities. Prehistoric and medieval antiquities are numerous. The most important traces of Neolithic man still visible are the burial-places (barrows) which are common in Breckland. Compared with Burgh Castle, all other Roman remains are insignificant. Here the original Roman walls are standing and are thought to be those of a first-century fortress connected with the Roman station *Gariononum*. The most important villas are those at Mildenhall and Ipswich. The most imposing Norman castles are those of Framlingham and Orford, their keeps being among the most perfectly preserved in Britain. Bungay Castle is also of note.

Chief Towns. The county town is Ipswich (which see). Aldeburgh, Lowestoft and Bury St. Edmunds will also be found in their alphabetical positions.

Beccles, with an area 2017 acres and a population of 6544 in 1931, is one of the chief towns of the Suffolk Broads, situated on the Waveney. It is increasing in popularity as a holiday resort, and also has printing and engineering works.

Eye, with an area of 4410 acres and a population of 1733 in 1931, is an ancient borough in the north-east of the county which was of importance in Saxon days, as shown by the evidence of the castle earth works, undoubtedly of pre-Norman construction.

Southwold, with an area of 590 acres and a population of 2753 in 1931, has been a borough since the Tudor period and was at one time a port of some size. It is known in history chiefly on account of the battle of 1672, in which the Dutch fleet was defeated by the combined vessels of England and France.

Sudbury, with an area of 1925 acres and a population of 7007 in 1931, is situated in the extreme south-west of the county. This is also a town of Saxon foundation which retains several old houses and a moat hall.

The town of **Neumarket** (population, 9753), famed for its seven race meetings a year, is just within the borders (see also CAMBRIDGESHIRE). **Felixstowe**, a holiday resort much patronized for its fine beach and sands, has a population of 12,037.

SUFFOLK, CHARLES BRANDON, DUKE OF (1484-1545). Son of William Brandon, he became Viscount Lisle in 1513 and Duke of Suffolk in 1514, in the next year marrying

Mary Tudor, sister of Henry VIII and widow of the French king Louis XII.

SUFFOLK, EARLS OF. The founder of the earldom was Roger de Ufford who, in return for services rendered to Edward III in his first Scottish War, was created Earl in 1337. Later he distinguished himself in the French War, and in particular played an honourable part in the Battle of Poitiers (1356).

On the death of the second Earl of this house without an heir, the estates reverted to the Crown, and were subsequently, in 1385, regranted to Michael de la Pole, Chancellor of England, by Richard II. Dissatisfaction with de la Pole's conduct of affairs led to his impeachment by his political enemies and, though Richard was reluctant to yield up his favourite, the Earl fled the country.

The third family to hold the Earldom of Suffolk was that of the Howards. Admiral Thomas Howard (1561-1626) distinguished himself in the fight with the Spanish Armada, and was created Earl by James I on his accession. The title again became extinct on the death of James, third Earl of this house, in 1683.

SUFFRAGE. See FRANCHISE.

SUGAR. One of the most important foods known. It helps to form fat in the body, and is a source of energy and heat. The most



SUGAR BEETS READY FOR TRANSPORT TO THE STATION AT CANTLEY, NEAR NORWICH

Photo Topical

common form—the lump or granulated sugar—is produced by extraction from sugar cane or sugar beets. Such sugar is 100 per cent carbohydrate. Maple sugar is made from



SUFFOLK

1. Clare. 2. Ford at Kersey. 3. Framlingham Castle, built in the later Norman period. 4. The Gateway of the ruined Benedictine Abbey at Bury St. Edmunds. 5. Guildhall, Hadleigh. 6. Willy Lot's Cottage at Flatford, centre of the Constable country. 7. Docks at Ipswich.

Photos: Taylor



CUTTING SUGAR CANE

the sap of the sugar maple, and contains 83 per cent carbohydrates.

Cane Sugar. A description of the cane plant will be found in the article **SUGAR CANE**. The cane, after being washed and cut into short lengths, or shredded, is crushed by passing between the rollers of a mill, thus extracting the juice containing the sugar. In many instances the crushed cane (*megasse* or *bagasse*) is moistened with hot water and passed through a second mill to extract more sugar. The juice is then purified by filtering and heating with chemicals, lime being added to remove acidity and prevent the formation of *invert sugar*. Bleaching is effected by treatment with sulphur dioxide.

The next stage is that of concentration, the juice being evaporated down until sugar crystals form. The pasty mass of syrup and crystals called *massecuite* is fed to a revolving centrifugal separator through whose perforated sides the uncrystallizable syrup is forced out, leaving the sugar crystals in the

vessel. This liquid, after being boiled and reboiled, becomes the molasses of commerce. The sugar crystals must be further refined and clarified, before ready for the market. *Brown sugar* is made from syrup yielded by first sugar.

Beet Sugar. Sugar was first extracted from the beet by a German scientist in 1747, but the industry was not developed until the nineteenth century. The beets, on reaching the factory, are first washed and conveyed to slicing machines, where they are cut by triangular knives into slices. These slices drop through an upright chute into a diffusion battery, consisting of a series of tall cylinders holding from two to six tons each. Warm water is run through the cylinders, passing from one to another throughout the battery, and drawing the sugar from the cells of the beet as it goes. This "diffusion juice," as it is called, contains from 12 to 15 per cent of sugar. The raw juice is next purified by being mixed with lime and

treated with carbonic-acid gas. The purified juice is then evaporated down until crystals form, after which the *massecuite* is treated in a similar manner to that of cane sugar.

Maple Sugar. The sugar maple is a large tree growing in south-west Canada and in the United States. The trees are tapped in the spring by boring a hole in the trunk and by means of a spout collecting the sap in a pail. The sap is then evaporated down until crystals form. See MAPLE.

History of Sugar as a Commodity. Sugar was produced in India in the first century. In the eighth century the Arabs conquered Spain; they introduced into that country the cultivation of sugar cane, and after discovery of America the cane was brought to the West Indies and in the sixteenth century to Brazil, finally reaching the United States at a later date. In more recent times it was introduced into Java, South Africa, Australia, and many other countries. Cuba and Java are the two leading sugar-cane producers of the world.

The world's production of beet sugar is, roughly, one-third of the total amount of sugar produced, or about 20,000,000,000 lb. out of a total of 60,000,000,000 lb. The leading beet-sugar countries are Germany, Russia, Czechoslovakia, the United States, France, and Poland. In Great Britain the sugar beet industry, with the aid of a Government subsidy, has made great progress in recent years, and over 200,000 acres are in cultivation.

SUGAR CANE. A giant perennial grass cultivated in tropical and semi-tropical countries, the source of over half the sugar of commerce. Sugar cane gives off, from a thick, solid root stock, numerous erect stems that grow from 10 ft. to 15 ft. in height and are from 1 in. to 2 in. in diameter. The stalk has no branches, but bears long and narrow leaves which are arranged in two rows. The chief sugar-cane regions are Cuba, India, Java, the West Indies, Mauritius, Peru, Hawaii, and the United States. At the present time Britain's chief supplies come from Cuba, Mauritius, British West Indies, and Peru, but Australia, Fiji and Natal also have large sugar estates.

Growth and Cultivation. The soils best adapted to the growing of cane are those that have a high degree of fertility and are also capable of retaining a large amount of moisture. This plant requires an abundance of water, and if the rainfall is not adequate, excellent results are obtained by irrigation.

Sugar cane is propagated for the most part by stem cuttings; seed is used principally for cross-fertilization and to produce new varieties. A field prepared for planting has great furrows, from 5 ft. to 7 ft. apart,

running from one end of the field to the other. In these the cuttings are laid horizontally, sometimes singly and often two or three abreast.

After the cuttings have been planted, soil is thrown over the furrows until the cane is covered. From these cuttings numerous shoots rapidly spring up, reaching their full height in about eight months. After the flowers begin to fade harvesting begins.

Harvesting. The canes are cut close to the ground with a long knife, then tied in bundles and carried to the sugar factory.

Scientific Name. The sugar cane plant belongs to the family *Gramineae*. Its botanical name is *Saccharum officinarum*.

SUGGESTION. This is the influencing of conduct by presenting a pattern for imitation, or by indirectly inviting a desired and natural reaction. It commonly carries the implication that the process is introduced unawares, without arousing the consciousness of the "suggested" person in the direction of the suggested response. The mechanism by which yawning is contagious is rather obvious; the sight of another yawning intensifies or releases slight tendencies in the same direction.

The mechanism of suggestion in the way of inducing belief is equally important. This appears realistically in the psychology of *conjuring* (which see). The spectator is convinced that coins are dropped into a hat by the tossing movements of the right hand (which is quite empty), when really the coin is dropped from the left hand, which holds the hat. The illusion—as is true of many illusions—is the result of suggestion.

Suggestion may also be used effectively to procure desired forms of behaviour. With children it may be far more useful than direct commands, in that it is likely to produce less friction and opposition, less sense of being inferior or being dictated to. The child often follows out the direct suggestions of an adult with the feeling that he is doing something of his own accord.

If our attitude towards a person is hostile or scornful, we may react negatively to his suggestions, doing the very opposite of the thing suggested.

Suggestion may have force if it comes to us repeatedly from a number of people, even though we have no particular respect for any one of them. In the same way we may come to accept beliefs and follow out lines of action which we should pooh-pooh as ridiculous or harmful but for the fact that we have seen them advocated daily in the newspaper we read or found them accepted by large numbers of the people we meet.

The suggestive influence of numbers upon

an individual is a most potent factor in group activities. It is one of the means by which a whole group comes to act in a body.

The effect of repetition of suggestion is well seen in the results obtained from extensive advertising.

A great deal has been heard in recent years about *auto-suggestion*, but it is doubtful whether this process differs fundamentally from that already discussed. Literally, auto-suggestion means self-suggestion and it is implied that giving suggestions to oneself has the same sort of effect as occurs when they are received from without.

The effectiveness of this so-called auto-suggestion seems to depend very much on the confidence one has in the person who advocates it, and so is really suggestion in the ordinary sense. See *PSYCHOTHERAPY*.

SUICIDE. Intentional death by one's own hand.

Christianity has always opposed suicide, accounting it a sin; and statistics show that the deterrent effect of religion is very great. Among Christian people, suicide is far more common with Protestants than with Roman Catholics. It is, however, less common among Jewish people than among Roman Catholics. In Japan, suicide under certain conditions is considered an act of honour. See *HARA-KIRI*.

The difference between the sexes is also very marked, and the proportion varies little from year to year in different countries, approximately three or four males committing suicide to each female. As to age, there are evident certain definite tendencies. In general, it may be said that the age at which women tend to commit suicide is much lower than that for men. Among all classes, the maximum is reached between fifty-five and sixty-five.

In Law, deliberate suicide is regarded as self-murder, and is accordingly a felony. It follows from this that any attempt at deliberate suicide is itself a crime. The legal term for deliberate self-murder is *felo de se* (which see).

A suicide pact is in law a double crime, the parties to it being guilty both of their own deaths and of the murder of each other. If one party carries out the pact and the other survives, the survivor may be convicted of murder.

SUITE. In music, a succession of short pieces placed together in order, and in the same or related keys. Originally a mere collection of independent pieces suitably related, from which the player was expected to select a number sufficient for the occasion, it has become a definite form comparable to, though less closely organized

than, the sonata form (which see). But it is doubtful if even the suites of J. S. Bach are intended to be played straight through as they stand; and in the earlier examples this is certainly not the case.

SULEIMAN, su' lay man (1494-1566). A Sultan of Turkey, known as **SULEIMAN THE MAGNIFICENT**, under whom the Turkish Empire reached the height of its power.

He captured Belgrade and pressed on into Hungary, winning in 1526 a famous victory at Mohacs. Twice he threatened Vienna, and though compelled to retreat, could never be forced to give up his hold on Hungary. He took Rhodes from the Knights of Malta, partially subjugated Persia, and showed his ambition to take part in European political affairs by making a treaty of alliance with Francis I of France. See *TURKEY*.

SULLA, LUCIUS CORNELIUS (138-78 B.C.). A Roman general and statesman, known as **FELIX (THE FORTUNATE)**. He was of patrician rank, and saw his first military service of note in the campaigns of Marius against Jugurtha, in Africa. Here he was very successful, and he repeated his triumphs in the wars against the Teutones and Cimbri, which raised Marius to the height of his power. In 93 B.C., Sulla was made praetor, in the next year went as governor to Cilicia, and on his return to Rome in 91 B.C. did excellent service during the Social War. He was made consul in 88 B.C. and entrusted with the conduct of the war against Mithridates, an honour which Marius greatly desired. The ill-feeling between the two resulted in a riot, headed by the adherents of Marius, and Sulla was compelled to escape from Rome to his troops in Campania. At the head of his legions, he returned to Rome and drove out Marius.

From 87 to 83 B.C., Sulla was engaged against Mithridates, whom he at last forced to submit to Rome.

Sulla was now declared dictator for an unlimited term. The laws which he promulgated were all directed toward the restoration of the powers of the Senate and the aristocratic party. In 79 B.C. he resigned, and spent his last years in retirement.



SULLA
A bust in the Vatican
Museum
Photo. Mannell

SULLIVAN, SIR ARTHUR SEYMOUR (1842-1900). An English composer who won fame in the field of light opera and in sacred music; born in London. His father was an Irish bandmaster and music teacher. In 1856 Arthur Sullivan won the Mendelssohn scholarship at the Royal Academy of Music.



SIR ARTHUR SULLIVAN
Photo: Brown Bros

Under this scholarship, he went to Leipzig Conservatorium. In 1861 he returned to London, where, early in the next year, the music to Shakespeare's *Tempest* was played in the Crystal Palace. For some years he was organist at Covent Garden theatre, London, and professor of composition at the Royal Academy, but after 1875 practically

all his energies were devoted, in collaboration with W. S. Gilbert, to the production of the famous Gilbert and Sullivan comic operas—light but attractive music very much on the model of Rossini. The most popular include *H.M.S. Pinafore*, *Pirates of Penzance*, *The Mikado*, *Patience*, *Iolanthe*, *Ruddigore*, *Yeomen of the Guard*, and *The Gondoliers*.

SULPHATES. Salts of sulphuric acid. As a rule they are stable crystalline compounds, more or less soluble in water, with the exception of the sulphates of barium, strontium, and lead. Sulphates have many important uses. The minerals heavy spar, gypsum, celestite, and Epsom salts are sulphates of barium, calcium, strontium, and magnesium, respectively. Copper sulphate or blue vitriol is used in a variety of industries, including dyeing and calico-printing; iron sulphate is used in making ink and as a medicine; manganese sulphate is employed in calico-printing; zinc sulphate in surgery, in calico-printing, and in drying oils for varnishes. A double sulphate of potassium and aluminium, known as alum, is a constituent of some baking powders. Every sulphate contains a group of associated atoms of sulphur and oxygen.

SULPHUR. A common, yellow, non-metallic element. It is not only essential for the life and growth of plants and animals, but is found, directly or in combination, in a vast number of manufactured products. Sulphur is present in the human body in the proportion of 0.25 per cent. It is one of the constituents of proteins. It occurs in many plants, such as onions, cabbage, garlic,

horse-radish, and mustard, and in eggs. The disagreeable odour of rotten eggs is caused by the formation of a sulphur and hydrogen compound. Sulphur also forms a sulphide with silver.

Sulphur has been known from the earliest ages, and because it burns at a low temperature, it was formerly called brimstone (*burn-stone*). It is found abundantly in a pure state in volcanic regions, and is also freely distributed in combination with other substances, notably metals. With several of these it forms valuable metallic ores, including pyrites, a sulphide of iron; galena, a sulphide of lead, blende, a sulphide of zinc; cinnabar, a sulphide of mercury, and stibnite, a sulphide of antimony. Calcium sulphate, or gypsum, is the most abundant mineral containing sulphur and oxygen.

Properties. Sulphur is a chemical element with the symbol S. It exists in several different physical forms, all identical chemically, and affording a good example of the property of allotropy (which see). Ordinary lump sulphur is a pale-yellow, crystalline, brittle solid, almost tasteless, and capable of giving out a peculiar odour when rubbed or melted. It is a poor conductor of both heat and electricity. It melts into a yellow liquid at the comparatively low temperature of 230° F., and possesses the peculiar property of becoming viscous or of solidifying, when heated to a higher degree. At about 482° F., the fluid is so thick that it cannot be poured from the vessel, but it becomes fluid again when the temperature is raised above that point. Sulphur boils at 832° F., emitting a yellowish-brown vapour, which condenses in closed vessels in the form of a fine, yellow powder called flowers of sulphur.

Sulphur ignites readily at a low temperature, and burns with a pale-blue flame, forming sulphur dioxide, which is a colourless gas. Divided into very fine particles, it oxidizes in moist air and forms sulphuric acid.

Uses. Sulphur is mixed with saltpetre and charcoal to form gunpowder, and is indispensable in the manufacture of rubber goods. Taken internally, sulphur is a mild laxative. Its occurrence in mineral waters gives them special value in the treatment of rheumatism. Sulphur baths are prescribed for eczema and other skin affections, and sulphur ointment is a cure for itch and ringworm. Sulphur is also employed to some extent in the manufacture of matches. In agriculture sulphur preparations are widely used to kill insects and plant diseases. Sulphuric acid enters into the manufacture of fertilizer, alum, dyestuffs, explosives, and bleaching preparations, and is important in

the electroplating, oil-refining, and mining industries.

SULPHURETTED HYDROGEN (HYDROGEN SULPHIDE). A poisonous gas with the odour of rotten eggs, a compound of sulphur and hydrogen. It occurs in mineral waters. It is made in the laboratory by the action of hydrochloric acid on iron sulphide. The gas burns with a bluish flame, is colourless, has a sweet taste, and is slightly soluble in water. Dissolved in mineral waters, it has medicinal properties in rheumatism and skin diseases. Its most important use is as a reagent in the chemical laboratory, and for analysing other substances.

Chemical Formula. The formula for sulphuretted hydrogen is H_2S ; that is, a molecule contains two atoms of hydrogen and one atom of sulphur.

SULPHURIC ACID, OR OIL OF VITRIOL.

An oily liquid manufactured for use in numerous industries. It is indispensable in the manufacture of explosives, artificial fertilizers, alum, nitroglycerine, glucose, phosphorus, and dyestuffs, and in the bleaching, electroplating, oil-refining, and mining industries. It is employed in the making of sodium carbonate (soda), which in turn is used in manufacturing soap and glass, and is an essential factor in the production of all other mineral acids. The manufacture of sulphuric acid is based upon the fact that it is formed when sulphur dioxide, the common compound of sulphur and oxygen, oxidizes in the presence of water. Its salts are called *sulphates* (which see).

When pure, the acid is colourless and odourless. It has great affinity for water, which it absorbs quickly from many organic substances. For this reason, it makes painful wounds if it touches flesh. In accidents of this kind, the acid should be washed off with water and the wound treated with sodium bicarbonate or limewater. Sulphuric acid chars wood, paper, starch, and sugar, and is often employed in the laboratory to dry gases, for it absorbs moisture from the air and from gases passed through it. Four parts of acid to one part of water raises the temperature of the water to boiling.

Chemical Formula. The formula for sulphuric acid is H_2SO_4 ; that is, a molecule contains two atoms of hydrogen, and the radical SO_4 . The latter is a group consisting of one atom of sulphur and four atoms of oxygen, which remain in association, acting as one atom, in chemical reactions.

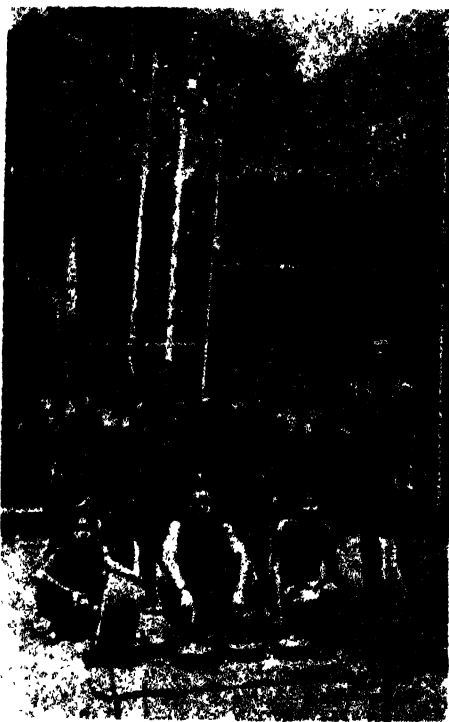
SULTAN. An Arabic title of honour, used since about A.D. 990 and applied to Moham-medan princes and rulers. The word means *emperor* in the modern sense, but more anciently referred to any person of great power or influence. The sultan of greatest dignity was the ruler of Turkey, prior to the new political order in the former Ottoman

Empire; to set him apart as greater than any other bearing the title, he was officially known as *sultan khan*, or *reigning sultan*. The form *sultana*, applied to the mother, wife, or daughter of the sultan, is not known in Arabic.

SUMAC, sū' mah or shu' mah. A genus of small trees or shrubs of temperate regions, consisting of about 120 species, many of which are commercially important. The most important is the Tanner's sumac which grows in Italy and other parts of Southern Europe. An extract, used in leather tanning, comes from its dried leaves.

Classification. The sumac genus, *Rhus*, belongs to the cashew family, *Anacardiaceae*.

SUMATRA, su mah' tra. The second largest island of the Sunda group and the sixth largest island in the world, lying in the Indian Ocean, and belonging to the Netherlands.



SUMATRA

Sundanese chieftain and members of his tribe.

Photo. OROG

Situated across the equator, south-west of the Malay Peninsula, with an area of 163,738 sq. miles, Sumatra has a population of 7,661,399 (1930), of whom only a small

number are white. The native tribes are of Malayan and Indian origin. The mountains are rich in minerals; the forests furnish teak-wood, bamboo, and valuable gums; in the fertile valleys grow the pepper and tobacco of Sumatra's important European and



BATTAK WOMEN OF SUMATRA

They are weaving cloth on their primitive looms.

Chinese trade Rubber production is constantly increasing Valuable petroleum fields are being exploited by Dutch and British capital.

There are few large cities; the most important are Palembang, in the south-east, and Benkulen and Padang, on the west coast. See EAST INDIES, DUTCH.

SUMERIANS, *sū me' rianz*. See ARCHAEOLOGY (Mesopotamia); CUNEIFORM

SUMMARY JURISDICTION, COURT OF. See PETTY SESSIONS, COURT OF.

SUMMER TIME. See DAYLIGHT SAVING.

SUMMONS. A document issued by a county court or court of petty sessions, ordering the person to whom it is addressed to appear before the court at a specified time and place. A summons issued by a county court states "You are hereby summoned to appear at a county court to be holden at — to answer the plaintiff to a claim the particulars whereof are hereunto annexed"; and then follow the particulars. A petty sessional court summons begins by reciting that "Information has been laid this day by —" and sets out the alleged offence, and then continues "You are therefore hereby summoned to appear before the court" at such and such place and time. A defendant who fails to appear to a county court summons is liable to have judgment given against him. Failure to obey a police court summons is in a way more serious, as the magistrate may order the defendant to be arrested.

SUMPTUARY, *sump' tū arī*, **LAWS**. See CONSUMPTION.

SUN. The most conspicuous of the heavenly bodies and the centre of the solar system, regarded as a star, and believed to be a gaseous mass, with its atoms stripped of most of their electrons. The earth is dependent on the sun for heat and light, and therefore for the necessities of life. The sun, however, is in fact one of the smaller stars.

The bright surface of the sun visible to observers on the earth is known as the *photosphere*. A cloak, or envelope, of flaming hydrogen, surrounding the sun, is called the *chromosphere*, and shows red, like a burning mass, through the spectroscope. The prominences observable are vast clouds of hydrogen extending up from the chromosphere. During eclipses, there may be seen a still more vast, luminous envelope, called the *corona* (see below).

Size and Density. The diameter of the sun is approximately 864,000 miles, or 109 times that of the earth, its distance from the earth is about 93,000,000 miles. The sun's surface area is 12,000 times and its volume 1,300,000 times that of the earth. Since its density is 1.41 times that of water, it is much less dense than the earth, whose density is 5½ times that of water.

Gravity on the sun's surface is 27.9 times as great as on earth; a person weighing 150 lb. on earth would weigh nearly two tons on the sun, and a body falling on to the sun's surface would fall 450 ft the first second, while on the earth the fall in the first second would be 16.08 ft.

Movement. The sun appears to move through the heavens; actually, the earth moves round the sun, but we are unable to feel that motion. In the spring, the sun rises a little farther north of east each day for three months in the northern hemisphere. At the summer solstice, it appears to stay at the same height for a few days, then starts on its journey southward. It not only moves north and south, but continually advances eastward among the stars, rotates on its own axis in twenty-six days, and completes a circuit of our heavens in a year. See also STAR—The Galaxy.

Composition. This is not known with certainty. If the sun is cooling, the process is so gradual as never to have been in the slightest degree noted. Since the earth has been inhabited, there has been time for the sun to burn itself out, if its heat were maintained by ordinary combustion. It is now considered possible that its heat may be maintained by the conversion of its mass into

heat. If this is the correct explanation, the sun still contains enough heat to supply the earth for many millions of millions of years.

In the gaseous mass composing the sun are present iron, titanium, calcium, manganese, nickel, cobalt, chromium, barium, sodium, magnesium, copper, hydrogen, zinc, cerium, strontium, helium, carbon, nitrogen, oxygen, silver, tin, and potassium.

Sun-Spots. The surface of the sun appears to be dotted with dark patches, irregular in shape and varying in diameter from 1000 to 50,000 miles. These are called *sun-spots*, and it is observed that they become more numerous at regularly recurring intervals.

By observation of sun-spots which pass round the sun, the time of the sun's rotation is calculated. The spots are apparently not attached to the sun's surface, but float about somewhat as clouds do in our atmosphere, causing differences in the calculated time of rotation, according to the latitudes on the sun at which the spots are located. It is possible that sun-spots are vast whirling storms, sometimes like tornadoes on earth, caused by the inflow of cooler gases from high levels. These spots are periodic in appearance, the average period being 11.1 years, but subject to variation. A magnetic field exists in and about every sun-spot, and it has been suggested that, when the spots are most numerous, magnetic storms are frequent and violent on the earth. The majority of sun-spots occur in pairs of opposite polarity.

The Corona. The corona is visible only during periods of total eclipse. The inner portion of the corona is intensely bright and dazzling, tapering in the outer corona to a soft, filmy light, with streamers spreading millions of miles into space. See ASTRONOMY; ECLIPSE.

SUN-BATHING. See HELIOTHERAPY.

SUN-BIRD. The name of a family of very small and very brightly coloured birds found mainly in Africa and India. They have a long bill and an extensible tongue, and feed on the small insect food about flowers. Sun-birds are very similar in appearance to the humming-birds of the New World, though they are not closely related. One difference by which they can immediately be distinguished is that humming-birds feed while on the wing, hovering in front of a flower, whereas sun-birds perch to feed.

Scientific Name. Sun-birds are of the family *Neoterniidae*.

SUNDA ISLANDS. Two groups of islands in the East Indies, extending from the Malay Peninsula to the Moluccas. Within recent years, the name has been less used, and is gradually disappearing. The Great Sunda Islands consist of Sumatra, Java, Borneo,

Celebes, Banka, and Billiton; the Little Sunda Islands are Bali, Lombok, Sumbawa, Flores, Sumba, and Timor. With the exception of part of Borneo, they are under Dutch rule. The islands are extremely productive, and carry on a large commerce in spices, fruits, copra, rice, coffee, cocoa, tobacco, and sugar.

SUNDAY. Among Christian nations the first day of the week, and a day of rest (Sabbath). It is not to be confounded, however, with the Jewish Sabbath, the seventh day of the week, its origin as a sacred day being due to the Resurrection of Christ on the first day of the week.

In the earliest days of the Christian Era, the status of the Christians was such that they had to work every day in the week, and there is no evidence that Sunday was at first regarded as a day of general rest. It was, however, set apart for worship. About the middle of the second century, the Church fathers began to discuss the question of forbidding the type of work performed by slaves on Sunday, but it was not until the fourth century (Edict of Constantine, A.D. 321) that the Church was able to enforce the prohibition.

SUNDAY OBSERVANCE ACTS. From early times laws have been enacted and (somewhat sporadically) enforced to prevent the profanation of the Lord's Day. The principal Acts of Parliament at present on the statute-book in this connection are the Sunday Observance Acts, 1677 and 1780, and the Sunday Entertainments Act, 1932. Anyone who publicly cries or exposes any goods for sale on Sunday is liable to forfeit the goods. The Act contains an express exemption in favour of persons "dressing or selling meat in families, inns, cookshops or victualling houses," or selling milk before 9 a.m. or after 4 p.m. In this case the courts have used their ingenuity and have stretched the phrase "dressing or selling meat" so as to apply to the sale of almost any kind of solid food. The Act of 1780 declared that any house, room or place used for any public entertainment or amusement on Sunday to which people are admitted by payment of money, or by tickets sold for money, is a disorderly house, and the persons responsible for it are punishable accordingly. Further, any "keeper" of such a house or "person managing or conducting" the entertainment or amusement or "acting as master of ceremonies" or as "moderator, president or chairman," as well as every doorkeeper, servant or other person who receives the money or tickets, and everyone who advertises the entertainment, is liable to penalties ranging from £50 to £200 to anyone who cares to sue for them (see

INFORMER, COMMON). By the Act of 1932 the ban was lifted as regards museums, zoological and botanical gardens, aquariums, picture-galleries, and public lectures and debates. The same Act empowered the local authorities responsible for the licensing of cinemas to permit Sunday opening on such conditions as the local authority should think fit to impose. It also empowered the local authorities who are responsible for the licensing of musical entertainments to grant licences for music to be played publicly on Sundays.

SUNDAY SCHOOL. An institution carried on in connection with churches for the encouragement of religious instruction, especially among young people. The movement was formerly known as the Bible School Movement.

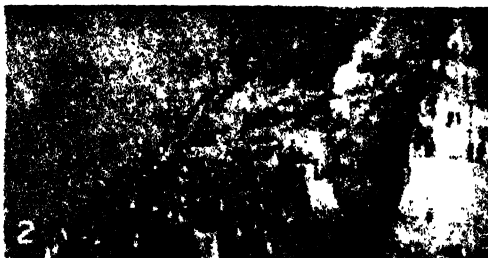
The movement was inaugurated by a benevolent publisher of Gloucester, named Robert Raikes. His first so-called "Ragged School" was started in 1780. The interest shown by the children, and the good accomplished, more than justified the experiment, and when such workers as John Wesley and George Whitefield, and even Queen Victoria herself, gave their support to the work, the movement spread rapidly. When Raikes died, in 1811, there were about 400,000 children in Sunday schools. To-day, the Sunday schools have several millions of students enrolled.

Religious instruction in the Roman Catholic and Anglican churches is given to all who attend the parochial schools, and those who

do not attend them are required to attend Sunday classes.

SUNDERLAND. A Parliamentary and County Borough of Durham with an area of 6959 acres and a population of 185,824 in 1931. It is the commercial and industrial capital of the County Palatine; from the reign of Henry VIII it has been prominent as a port for the shipment of coal, and to-day it is one of the largest centres of the coal trade of Great Britain. It is also claimed to be the largest ship building and marine engineering town in the world and one of the principal centres of the house furnishing industry in Britain. In addition to the glass-making industry, which has been connected with the town since the seventh century, and the timber trade, there are paint and veneer works, biscuit factories, chemical works, electrical and general engineering works, potteries, and paper mills. There are also factories manufacturing a wide assortment of foodstuffs and other commodities. The total water area of the docks, which are capable of accommodating the largest cargo vessels, is 211 acres.

The history of the town dates from the Saxon period. It is often referred to as Wearmouth, which is recorded as being a "borough" from time immemorial. It is known to have been the birthplace of the Venerable Bede, to have been laid waste by the Danes and to have grown again out of the ruins around the monastery, rebuilt in the eleventh century. The town was formally incorporated as a borough in 1634,



SUNDERLAND

1. Town Hall. 2. Roker Beach. 3. Wear Bridge.

Photos: Sunderland Corporation

and became a parliamentary borough in 1832.

SUNDIAL. The oldest device known for the measurement of time. The earliest mention of it is in the Bible, the probable date of the reference being about 700 B.C. The earliest sundial of whose construction there

gnomon is a straight edge of metal, set in the centre of the dial and pointing toward the North Pole. On sundials used in the southern hemisphere, the gnomon must point to the South Pole.

SUNFISH. There are several kinds of fish to which this name is applied. In North

America, the sunfish are a group of small, bright-coloured freshwater food fish, rarely over 10 in. long.

The name "sunfish" is also given to a group of grotesque-looking ocean fish which have the habit of resting on the surface in sunny weather, with one fin above the water. The body is scaleless, dull-



SUNDIAL

The time in some of the principal cities of the world can be seen on this novel American sundial.

Photo: Wide World

is certain knowledge is the dial of Berossus, a Chaldean astronomer who lived about 300 B.C.

Modern sundials are mainly for ornament. They are composed of two parts, the *dial face*, or *plane*, and the *stile*, or *gnomon*. The dial face is divided into quarters, and the dial must be set so that the dividing lines run toward the four points of the compass. The dial is further marked into hour spaces, with divisions of halves and quarters. The



SUNFISH

Photo: Weller

coloured, and clumsy, that of one species seeming to consist of one great head with small fins. They may weigh as much as 250 lb.

Scientific Name. Ocean sunfish belong to the family *Molidae*. The common Atlantic species is *Mola mola*.

SUNFLOWER. A flowering plant of the composite family, so named because of the great flower head, with its encircling rays of yellow petals. One of the best-known species is the annual kind, which under cultivation bears flower heads a foot in diameter. These heads are flattened discs, surrounded by circles of florets. The outer circle in each head is a row of large, yellow petals. The other florets, which form rows of concentric circles, are small, tubular flowers. The plant has a rough, hairy stem from 6 ft. to 10 ft. high, and coarse heart-shaped leaves. Numerous leaf-like bracts surround the disc, thus protecting the more delicate parts of the flower. The plant is

native to America, and besides being grown as a decorative garden flower, it is cultivated also for its seeds, which can be used as bird food, or crushed to produce a sweet oil of commercial value.

Scientific Names. The annual species is *Helianthus annuus*. Among the decorative perennials are *H. orgyalis* and *H. decapetalus*.



SUN FLOWERS
Photo: Carters

SUN-SPOTS.

See SUN.

SUNSTROKE AND HEAT- STROKE.

These names are given to conditions which result from exposure of the body to excessive heat; common in India and other countries with hot climates, they also occur in England in hot weather.

In the more

serious forms, that part of the central nervous system which is known as the *heat regulating centre* is put out of gear. It usually comes on quickly. The victim has a sense of burning heat all over the body; he becomes dizzy, cannot see clearly, and grows nauseated and faint; then he falls unconscious. The skin becomes burning hot and red, and there may be delirium, vomiting, and diarrhoea. The temperature will rise to 108° or more, in some cases as high as 115°. Such strokes may attack persons who have not been in the sun at all, but who are shut in hot rooms where the air has become foul.

The first thing to be done with a victim of sunstroke is to cool the body, by putting the subject in a cold bath or wrapping him in cold, wet sheets. Ice may be applied to the head or body or both. The application of cold must be continued until the temperature falls to 102° and remains below that level. Stimulants should not be given, for they tend to raise the temperature.

In the milder forms, the pulse becomes feeble, and the patient feels exhausted and is faint, but is not necessarily prostrated. The skin, instead of becoming burning red, is white and clammy. The subject may lose consciousness, and the temperature fall below normal, perhaps to 95°. Recovery, however, is usually a matter of a short time, the chief remedies being rest and stimulation. Cold is not required externally, except that a cold cloth may be placed on the head. Tea, coffee, or aromatic spirits of ammonia

should be administered, or a small quantity of whisky or brandy well diluted.

SUN YAT SEN, Dr. (1867-1925). Leader in the formation of the Chinese Republic and its first provisional President. He was born in Kwangtung province, of native Christian parents. From 1895 until after the revolution of 1911, he was an exile because of his connection with an attempted revolt.

In 1912, less than two months after his election as provisional President, Dr. Sun relinquished his office to Yuan Shi-Kai. In 1916 Yuan died, and the following year Dr. Sun declared himself the head of South China, a newly formed republic, though he was soon forced to relinquish the position. In 1921, however, he was recalled, but again



DR. AND MRS. SUN YAT SEN
Photo: Wide World

his inability to co-operate, and his feverish ambition, which urged him to expand into Northern China before his work in South China was well established, caused him to be exiled. In 1923 he became chief executive of Kwangtung and remained in that position until his death. See CHINA (History).

SUPERANNUATION SCHEMES. Schemes for providing an annual pension to a person on account of long and faithful service, old

age, or physical infirmity are nowadays quite a usual part of the organization of business firms, and the setting up of a pension or endowment scheme is looked upon as a wise financial provision. Superannuation schemes have been set up also for the Civil Service, railway and municipal employees, the elementary school teachers, the police, and other groups. Perhaps the most common arrangement is the contributory one, under which the employee contributes a part of the cost weekly, and the employer the balance.

Staff pension schemes may be based on pure pension principles, a fixed retiring age being selected, or an endowment scheme may be brought into operation. An actuary would generally be called in to advise the employer, or the pension fund may be managed entirely by an insurance company. The latter arrangement has the advantage of permanency. Even the winding-up of the firm will not prejudice a certain amount of security to the employee, as his previous accumulations would have a surrender value. When a contributory superannuation fund is not in the hands of an insurance company, its management will be vested in a committee composed of nominees of the employers and representatives of the staff. See PENSIONS.

SUPERCARGING. See PETROL ENGINES (Aero).

SUPERNATURALISM. The doctrine of a divine agency influencing terrestrial events (as in the miracles recorded in the Bible and in later times); and working in men's minds for their sanctification.

SUPERSTITION. Any practice, custom, or belief founded on primitive notions about the nature and influence of luck in human affairs. Primitive man knew so little in comparison with us about the working of natural forces that his world was full of mysteries, of problems beyond his understanding and forces beyond his control; and he had either to resign himself to complete helplessness or force himself to the belief that every mystery had its clue, if he could but find it; that every event was presaged by its appropriate sign, and every evil could be averted by the appropriate means, if he could but recognize the sign and discover the means. Many books have been written about primitive religions, ritual and magic, about taboos and fetishes, witchcraft, and divination and other strange practices. All this mass of detail springs from this one belief, the central dominating factor in the life of primitive man, that success and happiness depend on a perpetual vigilance in observing those signs and practices which are considered "lucky" and avoiding those which are "unlucky."

Modern Superstitions. A large number of superstitions have some degree of currency even among civilized peoples at the present day. Not all of these are of ancient origin; the subject-matter of some declares them to be of comparatively recent invention, while others appear to be in origin not really superstitions at all but rather maxims of prudence. Among superstitions whose origin is lost in antiquity are such beliefs as that it is unlucky to spill the salt at table, and the companion belief that the fault can be redeemed by throwing some of the spilt salt over the left shoulder, and the beliefs that it is unlucky to see the new moon's reflection in glass or water, or to cut an onion in half, or to leave a pair of bellows or new boots on the table; or on the other hand that it is lucky to wear a spray of white heather or four-leaf clover; and that a remark which might seem to tempt Providence can be rendered harmless by touching wood. The most widely respected of all superstitions are those relating to the number thirteen and Friday, which of course are of Christian origin, while the belief that it is unlucky to meet a clergyman when on board ship or when going hunting cannot be older than the Christian era. Examples of quite modern superstitions are the beliefs that it is unlucky to leave one's knife and fork crossed at table (forks were not used in England until late in the sixteenth century), or to break a mirror (glass mirrors are of quite recent introduction), or to open an umbrella in the house, or to light three cigarettes with one match. Among those which are of a practical nature may be mentioned the belief that it is unlucky to pass under a ladder or to be the first to enter a new house or to cross a bridge. Two superstitions which in their time have been the cause of much suffering, but which now, fortunately, have almost disappeared, at any rate from Western countries, are the beliefs in witches and in the "evil eye." It is not so long ago since even in England a woman might be burnt to death on being condemned as a witch, while social ostracism was the least that befell the unhappy wretch at whom the capricious finger of rumour pointed as the possessor of the evil eye. Modern superstition mainly takes the form of a harmless eccentricity, as in semi-serious acceptance of the prognostications of the fortune-teller.

SUPPLY AND DEMAND. In economics, *supply* refers to the quantity of goods that will be offered for sale, in a given market, at various prices; and *demand* refers to the quantity of goods that will be purchased at various prices. The relation between the supply and demand is said to determine the price of the commodity. If the supply is

great, as compared with the demand, the price will be low; and if the supply is small, as compared with the demand, the price will be high. See **VALUE**; **ECONOMICS**.

SUPPURATION. See **INFLAMMATION**.

SUPRARENAL, *su pra re' nal*, **GLANDS**.

See **ENDOCRINE GLANDS**.

SUPREME COURT OF JUDICATURE.

See **COURTS**.

SURETY. In law, anyone who agrees to be answerable for the debt or default of another. Contracts of suretyship are also sometimes called contracts of *guarantee* (which see). They must be evidenced by a written document signed by the surety, or by the surety's agent, otherwise they are not legally enforceable. When anyone is charged with the commission of a crime, and is released on bail pending his trial, he is usually required to find sureties who will make themselves answerable for the amount of the bail if the accused fails to appear.

SURGERY. In common with other departments of healing, surgery has made rapid progress since the beginning of the nineteenth century. Both medicine and surgery owe a debt, one that cannot be estimated, to three great discoveries of that century: anaesthesia, the germ origin of putrefaction and inflammation, and that reliable friend of diagnosis, the X-ray. In the days before anaesthetics were used, surgical operations entailed such agony that the surgeon was dominated by one idea, and that was to conclude his work as quickly as possible. To-day, he is able to perform delicate and intricate operations on the brain and abdominal organs, because he can work on a relaxed and unconscious patient who can be kept under anaesthesia as long as may be necessary. See **ANAESTHETIC**.

The great biological chemist Louis Pasteur laid the foundation for antiseptic surgery when his long-continued research revealed conclusively that certain one-celled organisms are the cause of infectious diseases, and that putrefaction is the result of bacterial activity. Joseph Lister, the famous British surgeon, applied Pasteur's discovery to his work, and about 1865 began a technique in the operating room that was to revolutionize surgical practice.

Lister developed a method of destroying the germs that were causing so many of his patients to die of blood poisoning, after successfully withstanding severe operations. The modern technique is a refinement of "Listerism," with the emphasis placed on keeping out infection by means of scrupulous cleanliness, entailing the sterilization of all instruments and materials to be used previous to the operation. See **ANTISEPTIC**.

The relation of the X-ray to diagnosis is of

fundamental importance. This great ally of the physician and surgeon alike was discovered in 1895 by Wilhelm Röntgen. By means of X-ray apparatus, shadow pictures are taken that reveal bone fractures, hidden objects such as bullets, lung tuberculosis, tumours and cancers, abscesses, gallstones, and many other abnormal conditions. The information thus revealed enables the surgeon to avoid unnecessary operations, gives him a definite idea of the location and nature of the ailment, and permits a refinement of diagnosis undreamed of in the era preceding Röntgen's discovery.

SURINAM. See **DUTCH GUIANA**.

SURPLICE. An ecclesiastical garment, which derives its name from the fact that it was worn by the clergy over (*super*) the customary furred coat (*pelliceum*).

As is the case with so many of the vestments used at different periods in the Church, the shape of the surplice has undergone many variations. Originally it was a long flowing garment of white linen reaching nearly to the feet, with very long and wide sleeves, and with a hole in the top, through which the wearer put his head. This is the "Comely large surplesse with wide and long sleeves" demanded of the Yorkshire clergy by Archdeacon Cosin in the Articles of Inquiry addressed to them in 1621.

The size of the surplice has continuously tended to become smaller, and the modern length does not usually extend further than a little above the knee. The sleeves have been proportionately reduced.

SURREY. A south-eastern inland county of England with an area of 461,833 acres and a population in 1931 of 1,180,810.

General Physical Features. The most characteristic feature of the scenery is the long line of the North Downs which extend from one end of the county to the other. The growing towns of Dorking, Reigate, and Redhill lie immediately under the Downs, which are broken by the Valley of the Mole near the first named. The highest point attained is at Titsey Hill in the extreme east (877 ft.).

Parallel with the North Downs and separated from them by a narrow valley is the line of the Greensand Hills. In the east these are low and disjointed, but exceed 400 ft. at Tilbury Down Hill. Further west they form a magnificent series of hills which include Leith Hill, Holmbury Hill and Pitch Hill. Then after falling to the Valley of the Wey they rise again in the heather-clad heights of Hindhead. The three highest points are Leith Hill, 965 ft., the highest point in the county; Gibbet Hill, 804 ft.; and Holmbury Hill, 857 ft.

Apart from insignificant tributaries of

the Arun and Medway, Surrey drains into the Thames. The Thames itself forms the northern boundary from Runnymede to the confines of London.

History. The early history of the county must be considered in relation to its physical features. The chalk downs, like the Sussex downs, were the natural stronghold of pre-historic peoples, especially those who advanced westwards from the continent. In medieval times, however, the poverty of the

Saxon kings were crowned from the time of Athelstan to that of Edmund Ironside.

The Norman Conquest was effected without incident. The land was still impoverished except in the environs of London, but a number of Norman castles were erected, including those at Guildford, Bletchingley, and Reigate.

The signing of Magna Carta at Runnymede, the razing of Guildford in the rebellion of Wat Tyler, and the plundering of the



chalk, the heather moors of the sand, and the boggy nature of the Weald conspired to make Surrey far less prosperous than the neighbouring shires. It is not surprising therefore to find that traces of Palaeolithic and Neolithic man are moderately plentiful, but, of the Roman occupation there is little evidence pointing to domestic influence.

It is known to have formed part of the Kingdom of Mercia, and in the ninth century to have passed into the hands of the Kings of Wessex. The Danish invasions are of particular interest, for it was at Ockley, during the earlier inroads, that the invaders received their first and most disastrous check. The importance of the county during the later Saxon period is shown by the existence to the present day of the Saxon coronation stone at Kingston-upon-Thames where the

country mansions by Jack Cade were the principal events of the thirteenth, fourteenth and fifteenth centuries respectively. Richmond, Guildford and Kingston (which see) were throughout the Middle Ages the towns of principal importance in the county. In the Great Rebellion the county on the whole favoured the cause of Parliament. Recent history has been concerned with the absorption of much of North Surrey into the outer fringe of London's suburbs and with the consequent change from a purely agricultural county to a dormitory of the metropolis. The parliamentary representation of the county is limited to seven Members, but, in addition, the borough of Croydon returns two members, and the boroughs of Kingston, Richmond, and Wimbledon one Member each.

Communications. As a metropolitan county Surrey possesses excellent roads the



SURREY

1. The Devil's Punch Bowl, near Hindhead. 2. Wray Common. 3. Guildford Castle, of early Norman construction. 4. Tilford Bridge, River Wey. 5. View from the chalk ridge of the Hog's Back. 6. Ancient clock overhanging the road at Abinger Hammer. 7. Cap Mill, Ewhurst, now a dwelling. 8. The North Downs at Oxted.

Photos: Frith; George Long

majority, even of the byways, being well surfaced. River transport on the Thames is of importance, and Kingston is a centre for barge traffic. The Wey is also navigable to Godalming. Railway communications are maintained by the Southern Railway. Surrey is perhaps the best served of any county in this respect.

Agriculture and Industries. As in most districts of England, there is a marked tendency in agriculture for corn crops to be displaced by permanent pasture. A large area in the sand is necessarily barren, although useful in the production of coniferous trees. Until the present century the principal crop was wheat, but in the decade 1910-1920 this was displaced from the first place by oats. Barley and rye are other cereals cultivated in relatively small quantities. Among root crops turnips occupy the principal acreage, followed by potatoes. Market-gardening for the London market is on the increase in North Surrey and is gradually extending further south. There are nearly 40,000 cattle and 30,000 sheep, the sheep walks on the North Downs being particularly suitable. Pig-breeding, often allied with chicken-farming, is also carried on profitably. Racehorses are bred and trained on Epsom Downs.

Manufacturing industries, apart from those carried on near London, are few and unimportant. Brewing is probably the most widespread, and there are small local industries, including the manufacture of many varieties of foodstuffs, saw milling, printing and engineering at many of the larger towns such as Kingston, Richmond, Reigate and Guildford. Historically, Surrey is the home of many interesting occupations. The ancient iron foundries of the Weald may be as old as those of Sussex. They certainly continued as a flourishing industry until the eighteenth century. Traces of the ancient ironworks can still be seen at Thursley. The medieval cloth trade was vigorous at Guildford and lasted until the seventeenth century.

Antiquities. On Crooksbury Hill near Farnham there are mounds thought to be of Neolithic date. Caesar's Camp on Wimbledon Common is much earlier than its name implies. The chief monument of the Roman period is the foundation of the Roman villa brought to light in Titsey Park. The traces of Stane Street, which passes through the county from Chichester to London, are poorly marked, but the Pilgrim's Way, following the lower slopes of the North Downs, represents a prehistoric trackway. Saxon architecture is confined to work in a few of the churches: the tower of the Church of St. Mary at Guildford and the nave at Ashted Church are two of the most noteworthy examples.

Of the medieval castles the ruins of Guildford Castle are early Norman. The ruins of Bletchingley and Reigate, though of similar date, are too small to be of great interest. The thirteenth-century Farnham Castle is a fine specimen of a later date. The most picturesque monastic ruins are those of Waverley Abbey, situated in the bend of the Wey between Elstead and Farnham. This was the first Cistercian house established in England. Newark Priory was a house of the Austin canons, and Chertsey Abbey, of which little survives, was a Benedictine monastery.

Chief Towns. The county town is Guildford (which see). The county borough of Croydon, the boroughs of Kingston-upon-Thames, Richmond and Wimbledon, and the urban district of Epsom and Ewell will also be found in their alphabetical position. The remaining boroughs are—

Godalming. Area 1332 acres, population 10,400 in 1931; an ancient town which has existed as a borough since the reign of Queen Elizabeth. The tower of the parish church contains some notable Norman work, and there are a number of Tudor houses in the main thoroughfare. Being the highest point to which the Wey is navigable, Godalming has had some commercial importance. The principal modern industry is tanning.

Reigate. Area 5095 acres, population 30,830 in 1931; a growing residential town at the foot of the North Downs. The mound only of the Norman castle of William de Warenne survives. Reigate Priory, largely rebuilt, is on the site of the original priory of the Austin canons founded in the thirteenth century.

SURREY, EARLS OF. A title of nobility first held by the heads of the Norman family of Warenne. William de Warenne fought at Senlac and the earldom was bestowed on him by William Rufus in 1188.

On the death of the third Earl in the direct line without male issue, the title passed by marriage to another branch, who styled themselves Earls of Surrey and Warenne. Of these the most distinguished was John, the third of the line, who led the barons in opposition to Edward I at the beginning of the reign. Later he became Warden of Scotland.

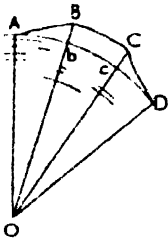
On the death of the fourth Earl without issue, the estates reverted to the Crown, and the earldom was granted to Fitzalan, Earl of Arundel, who fought at Crécy. Later (1483) the earldom passed to the family of the Howards, Dukes of Norfolk and Earls Marshal of England. The Howards played a prominent part in the political and religious conflicts of the sixteenth century. Thomas Howard, the third Duke, was the uncle of Queen Anne Boleyn.

His son was Henry Howard, called Earl of Surrey by courtesy and famous in the history of English literature as the first to introduce blank verse. He was also, with Sir Thomas Wyatt, the first to use the sonnet form, which they borrowed from Italy.

SURTAX. A graduated scale of tax additional to income tax payable on large incomes.

SURVEY, AERIAL Aerial photography is now used to survey towns and areas where other methods prove difficult. The pictures are taken vertically at intervals from a plane flying at a constant height to secure overlapping photographs covering the entire area. These are joined up (the overlapping parts being omitted) so that a single aerial photograph is obtained. From this maps are prepared. Non-vertical aerial photographs have been of great value in surveying prehistoric sites—many encampments, long barrows, and other relics being discovered by this means.

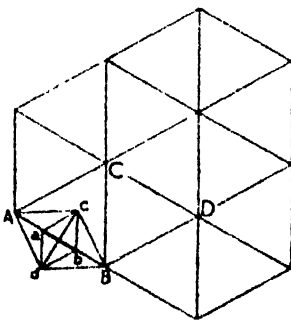
SURVEYING. The art of representing on paper to scale the natural and artificial features of a portion of the earth's surface, as projected on sea-level. This implies that



all distances and angles must be measured horizontally, and distances must be reduced to their equivalents at sea-level. The earth is a spheroid of 3957 miles average radius, so that a distance BC (Fig. 1) measured at 5280 ft. above sea-level must be reduced by $\frac{1}{2500}$ its part to be. Another branch

of surveying is *Levelling* or the determination of heights above sea-level, and their representation on the map or survey by figures, contour lines, or coloured layers.

Triangulation. A fundamental principle in surveying is to "survey from the whole to the part," and for this purpose the relative positions of points, or "stations," as far apart as possible are first determined by a



determined by a "Primary Triangulation" (Fig. 2). A "Base Line" ab from 1 to 5 miles long is

first measured several times with great accuracy; it is then "extended" by measuring the

angles at a, b, c, d, A and B with a theodolite, and the length AB is calculated. The whole area to be surveyed is then covered with triangles whose sides will be some 30 miles in length—often much more when across the sea—and which are arranged to form interlocking polygons. All three angles of each triangle are measured with the theodolite and the lengths of the sides are calculated by trigonometry. It is thus unnecessary to measure any lengths other than that of the base-line, though on very large surveys "check-bases" are measured at intervals to prevent the accumulation of small errors.

Base-lines are measured with metal tapes or wires suspended over pulleys on tripod stands (Fig. 3) and stretched by a weight, by,

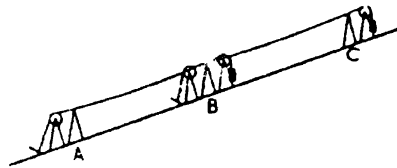


FIG. 3

which means the length of tape between two index marks A and B on tripod stands is read off, then the tape is moved forward, and the process repeated from B to C and so on. The temperature of the tape and the difference of level of each pair of index marks $A, B; B, C$, etc. must be measured. The length of each span of the tape is then corrected for temperature, tension, sag (i.e. curvature of the tape), slope and height above sea, and the corrected lengths added together. The angles of a primary triangulation are measured on theodolites of some 12 in. diameter to single seconds (the thickness of a lead pencil 1 mile away subtends an angle of 1 sec.) a number of times, but when the three angles of each triangle are added up, there is always some discrepancy from 180 degrees. In large triangles this is partly due to "spherical excess," amounting to 1 in. for each 76 sq. miles of area, as the earth is curved; after allowing for this, all the angles of the triangulation are "adjusted" by the "Method of Least Squares," a very laborious process, for their probable values. Base lines are measured to an accuracy of from 1 in 100,000 to 1 in 1,000,000, and the accuracy of triangulation will be seen from the fact that the British Ordnance Survey, starting from a base on Salisbury Plain and tested on a check base by Lough Foyle in Co. Londonderry, revealed only an error of $3\frac{1}{2}$ in. in 5 miles. The latitude and longitude of the various stations must be determined by astronomical observations, or computed by distance

and direction from an adjacent station, so that the stations may be plotted to some suitable "Map Projection," for it is obvious that it is impossible to represent any large portion of the earth's *round* surface on *flat* paper without some variation of scale over the map. A straight line has a constant direction on paper, but a straight line on the earth's surface is a "great circle," whose direction is constantly changing.

In large countries, e.g. India, it would take too long and prove too costly to cover the whole country with a primary triangulation, so "chain-triangulations" are run along meridians of longitude and parallels of latitude at considerable intervals apart. After the primary triangulation, "secondary" and "tertiary" triangulations are conducted, dividing the area up into smaller and smaller triangles, the latter having sides of only a mile or two in length. Each triangulation connects the stations of the next higher one, so that any discrepancy found may be "adjusted," i.e. distributed evenly over the triangulation of lesser accuracy. All stations are marked thus, \triangle on the map; on the ground they are marked on large buried stones or in some other permanent manner.

Theodolite. See separate article.

Detail Survey. So far we have merely surveyed a "skeleton," but a very accurate one, of triangulation stations, which we have now to clothe with the "flesh and blood" of the detail, the method varying with the character of the country.

Chain Survey. This is usually the method adopted in open country, full of detail. It consists in dividing the area between the tertiary triangulation stations into smaller triangles and measuring all three sides of each triangle with a surveyor's chain, 66 ft. or 100 ft. in length, each divided into 100 links. Substations shown by \odot are chosen to form the angular points with the triangulation stations themselves, and the lines are arranged so as to follow the detail as closely as possible; while there must always be at least one more line measured than is necessary to plot each triangle, so as to give a check on the field measurements and on the plotting. As each chain length lies on the ground, the surveyor measures perpendicular "offsets" with a tape to the angles in the detail, and he enters the "chainage" and the "offset" of each point *upwards* in his field book. The end of each chain length is marked with an "arrow" or pin; as these are picked up they record the number of chain lengths. "Ranging rods" mark the substations, and a line across a hill or valley must first be "ranged" with

rods in line: by "trial and error" if necessary. When chaining up or down a slope, the chaining must be "stepped" in horizontal half-chains (or less), or the surveyor chains on the slope and corrects each arrow by an amount varying with the slope.

Traverse Survey. In a town or village, or among woods and lakes, it would be impossible to measure all the sides of the necessary triangles, so "traversing" is adopted, Fig. 4, i.e. lines are chained where possible with offsets to the detail, and the angles between the lines at the substations are measured with a theodolite.

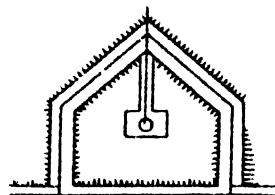


FIG. 4

The traverses connect up to the triangulation points and to each other so as to form a series of "closed traverses," or polygons. This provides a check on the angles, as "all the interior angles of a polygon of n sides $+ 360^\circ = 2n \times 90^\circ$." But errors are more probable in chaining the sides and, when plotted, "closing errors" are found, i.e. the traverse does not return to its starting point. Such errors must be "adjusted," i.e. distributed over the polygon in the most probable way. Another use of a traverse is for a "Strip Survey" of a long narrow object, e.g. a road or river, but it should begin and end on triangulation stations.

Topographical Surveys. For surveys on a small scale of country not highly developed, the *Plane Table* is most suitable. It consists of a drawing board mounted on a tripod stand, on which it can be rotated and clamped in position and levelled with a spirit level. With it is used an "Alidade" or straight-edge, with sights at each end. The survey is plotted

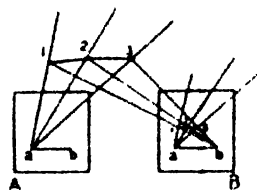
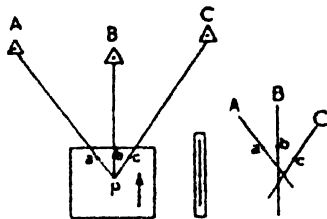


FIG. 5

in the field, and much minor detail can be sketched in. In Fig. 5, *A* and *B* are two substations already fixed and plotted on the paper as *a* and *b*. The table is set up at *A* with the point *a* vertically over *A* and "oriented" by turning it until the alidade, laid along *ab*, points to *B*. Then with the alidade "rays" are drawn from *a* to points to be surveyed, say, 1, 2, 3, etc., the bends on a river. The table is then moved to *B* and set up with the point *b*

vertically over B , and the alidade, laid along ba , pointing to A ; rays are then drawn from b to the points 1, 2, 3, etc., which, intersecting the previous rays, fix the positions 1', 2', 3', etc.

Resection. As there will only be a few triangulation stations available, many substations will have to be fixed at points from which the detail is clearly visible, and this is easily effected if three triangulation stations (or previously fixed substations) are visible from each of such points. Let A, B, C be



the three visible stations (Fig. 6). The table is set up at P (say) and oriented approximately by a "trough compass," laying it along the magnetic North-point on the paper and turning the table till the needle is central. Rays Aa, Bb, Cc are then drawn backward; if they meet at a point p , the table is correctly oriented with abc parallel to ABC , and the point p represents the point P vertically below it on the ground. If a small "triangle of error" is formed by the rays, a slight rotation of the table will make this vanish.

Photographic Surveying. This is the most modern method of detail surveying, but as effected from the air is beyond the scope of this article. As effected from the ground,

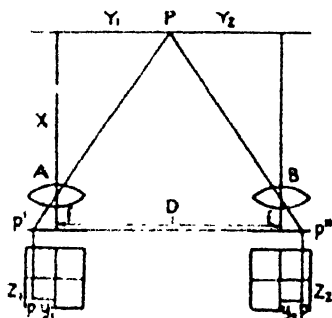


FIG. 7

the modern method is to take two photographs with a "Photo-Theodolite" from two known points A and B (Fig. 7), say, 100 yds. apart, the axis of the camera in each case being perpendicular to AB . The instrument is a combination of a camera and a

theodolite: the camera is of a fixed focal length f , and a vertical and a horizontal cross-hair are in contact with the plate, and are photographed thereon. The distances y_1, y_2 of the images p_1, p_2 on the negatives taken at A and B of a point P are measured,

and we then have $Y_1 = \frac{X}{f} y_1, Y_2 = \frac{X}{f} y_2$.

$Y_1 + Y_2 = (y_1 + y_2) \frac{X}{f} = D. \therefore X = \frac{f}{y_1 + y_2} D$,

then $Y_1 = \frac{X}{f} y_1$. If Z_1 is the height of P

above the camera at A , we have $\frac{Z_1}{z_1} = \frac{PA}{p'A}$

$= \frac{X}{f}. \therefore Z_1 = \frac{X}{f} \cdot z_1$, so that heights can be

found. In practice, the two negatives are placed in a stereoscope and an intensely "solid" view is obtained. By screw motions the negatives are moved about until fixed indices in the two eye-pieces (which appear as a single mark when viewed with both eyes) appear to touch the required point P , when the co-ordinates of P , viz. X, Y, Z , are read off on scales, or the point P can

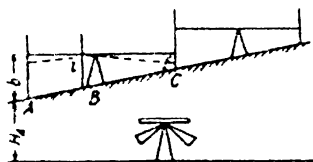


FIG. 8

even be drawn on a table behind the stereoscope by a pencil connected by links and gearing to the screw motions. The telescope of the theodolite rotates in a vertical plane perpendicular to the axis of the camera, so that when B is sighted from A (or *vice versa*) the camera axis is perpendicular to AB . The distance AB is read by "Tachymetry," i.e. by reading from A the length intercepted on a graduated staff held at B between two extra cross-hairs in the telescope.

Determination of Heights. Levelling is effected most accurately with a surveyor's level and staff, which is graduated in feet, tenths and hundredths of a foot. The level consists of a telescope fitted with cross-hairs, and with a long and sensitive spirit-level attached to it. The telescope can rotate round a vertical axis, and can be roughly levelled by means of three levelling screws and a circular spirit-level; when taking a reading on the staff, the bubble in the long spirit-level is made exactly central by turning a fine screw under the eyepiece of the telescope, the bubble being reflected towards the eyepiece for this purpose. The "line of sight" should then be horizontal. Starting

from a known level (or bench-mark) *A* (Fig. 8), the staff is held on this and the level set up at *B*: a "backsight," *b*, is read on the staff. The level of the "line of sight" is $H_A + b$. If a "foresight," *f*, is now read at *C*, the level of *C* is $H_A + b - f$. If the level of any other point *D* is required, an "inter sight" *i* is read on it and its level is $H_A + b - i$. The level is then moved forward and the process repeated. It is important to set the level midway between the backsight and the foresight, for if the instrument is out of adjustment, so that when the bubble is central the line of sight is inclined (as shown in broken lines), the errors in *b* and *f* will be equal and the level of *C* will be unaffected. The whole country is thus covered with "bench-marks," and contour lines can be set out by making $H_A + b - i =$ a contour level and finding points where the reading is *i*.

SUSSEX, *sin' sa* See PERSIA

SUSPENSION BRIDGE. See BRIDGE.

SUSSEX. A south-easterly coastal county of England, with an area of 932,471 acres, and a population in 1931 of 770,078.

Physical Features. The general physical characteristics of the county fall into several well-marked divisions.

The South Downs extend from the Hampshire border to Beachy Head in a continuous line, broken only by the valleys of the Arun, Adur, Ouse, and Cuckmere. The escarpment on the north rises abruptly from the Weald, but on the south the slope is more gentle. Here there is an upland plateau of three to five miles in width, with a secondary line of peaks of which Cissbury Ring is one. East of Brighton the southern slopes are bounded by the sea, and end in a bold line of chalk cliffs extending from Brighton to Newhaven, and from Seaford to Eastbourne.

From east to west, Firtle Beacon, Ditchling

Beacon, the Devil's Dyke, near Brighton, Chantonbury Ring, Bignor Hill, Goodwood and Bow Hill are a few of the most outstanding places of natural beauty. The coast-line, apart from the cliffs which at Beachy Head attain a height of 500 ft., is predominantly flat. From Hastings to Cliff End there is a range of sandstone cliffs.

The Weald proper consists of all the country between the North and South Downs, yet in Sussex two distinct lines of hills may be traced in it. The first and most prominent is the Forest Ridge, a district composed of the Hastings sand rising from the clay near Horsham, and extending east to the neighbourhood of Balcombe and Rotherfield, then passing south-east to the sea near Hastings.

The other range of hills is composed of the Lower Greensand, and extends across the west of the county from Petersfield to Petworth.

The rivers of Sussex are unimportant. The chief are the Ouse, the Rother, the Arun, and the Adur; the Cuckmere has a course of only a few miles.

History. The history of Sussex is the epitome of the history of all England. The first landing of Julius Caesar took place at Pevensey; Roman legionaries almost certainly marched over the Downs. The second invasion was completed successfully, and Sussex became one of the districts over which the Romans held undisputed sway. Chichester (Regnum) was for a time the capital of the Roman province. From the existence of Roman villas and of first class roads, it must be concluded that the occupation was domestic as well as military. The supposed sites of Roman stations are too numerous to mention. In the years of disorder following the withdrawal of the Romans, Sussex for a time formed the independent Kingdom of





SUSSEX

1. Soupting Church, with Saxon tower. 2. The South Downs near Bramber. 3. Gateway (about 1340) of Battle Abbey, founded for Benedictine monks on the site of the Battle of Hastings (Senlac) by William the Conqueror in fulfilment of a vow. 4. Bosham, the sea front. 5. Lullington Church, claimed as the smallest parish church in England. 6. West wall of the inner (Norman) castle of Pevensey. 7. The Seven Sisters from Cuckmere Haven.

Photos: George Long; Taylor, P. Green



SUSSEX DOWNS

Photo: Brighton Corporation

the south Saxons, from whom it has taken its present name. Later it was subjugated by the great southern Kingdom of Wessex. The coast-line was subject to Danish incursions, and a tradition of their conquests is perpetuated in the name of Dane Hill. Pevensey, again, was the scene of the landing of William of Normandy. The battle of 1066 which sealed the fate of the Saxons was fought at Senlac, near Battle Abbey.

The succeeding centuries witnessed the rise of the great Norman barons and the building of the great castles.

Other events of national importance which have taken place in Sussex include the Battle of Lewes, 1264, in which Simon de Montfort was victorious over Henry III's troops, and the sieges of Bramber, Arundel, and Chichester during the Civil War. The Cinque Ports, constituted with special privileges, included Hastings, and later, Winchelsea and Rye.

The wars with Napoleon were the cause of many alarms and excursions, although no actual landing was attempted. The line of Martello towers is a still present memorial of this period. At the present time the county returns six Members to Parliament.

Antiquities. Many traces of Neolithic man have been discovered. At Cissbury, pits can

still be seen which mark the earliest flint mines in this country. Here, and at Chanctonbury, numerous flint instruments have been discovered, and at Park Brow, on the Downs above Worthing, there are traces of a flourishing hill-top village, as there is also at Mount Caburn, near Lewes.

It was in Sussex, in the village of Fletching, that the Piltdown skull was discovered in 1912, believed to be belonging to a race anterior to the Palaeolithic.

The Roman era is well represented. The Roman walls at Pevensey are remarkably preserved. Chichester has many links with that time, including the Neptune and Minerva slab. The Roman road which ran from here to London (Stane Street) is in places, especially on the Downs, intact. Near it, under the northern escarpment, the Roman villa of Bignor shows the foundations intact, with much tessellated pavement.

The most interesting Saxon work is in the tower of Worth Church and in Bosham Church, which is reputed to be on the site of a Roman temple. The only memorial of the Danish invasions is in the names of certain places such as Dane Hill. Medieval castles are numerous. Some of the finest ancient masonry is built into the modern castle of Arundel (which see). The ruins of Bramber

are well situated, but only the moat and fragments of the wall remain of the Norman castle. Pevensey, the Roman Anderida, is a composite work, chiefly of Norman and later periods. Other fortresses of note include Bodiam and Hurstmonceux, both rebuilt; and Lewes and Hastings, of which only insignificant fragments remain.

Lullingston Church near Alfriston is claimed to be the smallest parish church in England. In fact, the church consists only of a chancel. The churches of Piddinghoe, Southease, and St. Nicholas, Lewes, are unique in having round Norman towers, which were probably erected to assist navigation up the Ouse. Old market crosses are found at Alfriston and Chichester. The most historic private mansion is Cowdray, of which the ruins are a mixture of Elizabethan and Tudor.

Agriculture and Industries. Historically, agriculture is the occupation of first importance. In the inland districts it remains so, but an increasing capital is tied up in the industry of catering for holiday-makers.

The Arun Valley and parts of the Weald are the most favourable for intensive cultivation. Wheat is the most important cereal, but oats and barley flourish in many districts. The cultivation of hops is nearly extinct. Cattle and pig breeding and sheep

rearing are extensively carried on, and Southdown cattle and sheep have a high reputation. Large herds of oxen and flocks of sheep are a common sight in the downland country. The only waste ground of any extent is in the Forest Ridge, where the desolate heather-clad moors of Ashdown Forest yield only a poor pasturage for a few sheep. The woodlands of the Forest Ridge are valuable, however, but undeveloped.

Formerly shipbuilding was carried on at numerous coastal towns, including Hastings. This has largely ceased, but the passenger shipping on the cross-channel services and on the coastal pleasure routes is still considerable. Brewing represents the chief productive occupation. From the time of the Neolithic flint mines, mining has been intermittently carried on. In the Middle Ages iron ore was extensively raised from the Hastings sand, and the Sussex iron trade was the most important of its kind in the country. At the present time building stone and chalk are quarried in addition to small quantities of the well-known Sussex marble.

Communications. Roads, both first- and second-class, are of a high order and are practically all constructed with a metalled surface. Numerous lines of the Southern Railway give direct communication with London to the coast towns and most others.



ARUNDEL

Looking upstream towards the Castle. The Catholic church is on the left

Chief Towns. The county town is Lewes (which see). Arundel, Brighton, Chichester, Eastbourne, Hastings, Hove and Worthing will also be found in their alphabetical position in these volumes. Of these, Brighton, Eastbourne, and Hastings are county boroughs and the remainder municipal boroughs. The only other boroughs are: Bexhill (area 7993 acres; population in 1931, 21,229), a flourishing seaside town which has grown out of Hastings which it adjoins on the east, and Rye (area 985 acres; population in 1931, 3947), an ancient port of Saxon foundation, later one of the Cinque Ports (which see), and now likely to regain some of its former prosperity with reconditioning of the harbour. The church, which is in parts Norman, is one of the largest parish churches in England.

SUSSEX, EARLS OF. Robert Radcliffe, or Ratcliffe, the first Earl of Sussex, was born in 1483 and died 1542. His father was John Radcliffe. In 1515 he took part in the ceremonial to mark the making of Wolsey a Cardinal. For military and State services he was created Viscount Fitzwalter in 1525, and on 8th December, 1529, as a reward for supporting King Henry VIII in the matter of divorce, he was created Earl of Sussex. In 1540 he was made Great Chamberlain of England. His son Henry, the second Earl, died in 1557.

The third Earl of Sussex was Henry's eldest son Thomas, born 1526. He rendered important military services to King Henry VIII and to King Edward VI, and he was one of the witnesses of the will of that monarch by which the succession to the throne was accorded to the Lady Jane Grey. Later, however, he gave his adherence to Queen Mary and assisted in the suppression of Wyatt's rebellion. He took a leading part in the negotiations for the marriage between Queen Mary and Philip of Spain. He was appointed Lord Deputy of Ireland in 1556. He died 9th June, 1583, and was succeeded by his brother Henry, who died 24th February, 1561.

Robert Radcliffe, the fifth Earl, his son, was a distinguished patron of men of letters. After his death the succession passed to his cousin, upon whose death without issue, in 1641, the title became extinct.

SUSSEX, KINGDOM OF. Corresponding closely to the territory now known as the County of Sussex, the Kingdom of Sussex (from *Suo Seaxe*, South Saxons) was one of the kingdoms of Anglo-Saxon Britain. The Saxon invaders, under Ella (Aella) and his son Cissa, according to such records as are available, conquered the Saxons as early as A.D. 477, and soon afterwards Ella declared himself king of Sussex and proceeded to

increase his power in southern England. Following a battle near Pevensey, the annals are silent about the Kingdom of Sussex until A.D. 607, when Ceolwulf of Wessex was in conflict against its ruler. In A.D. 681, Wilfrid of York came to Sussex from the North and endeavoured to convert its then pagan people to Christianity. Aethelwald, king of Sussex, had been previously baptized in Mercia. Selsey was made a bishopric, and so remained until the arrival of William the Conqueror, who chose Sussex as the starting-point for his conquest of England. Through several centuries preceding that event there had been frequent conflicts between the South Saxons (Sussex) and the West Saxons (Wessex), and the latter, from A.D. 825 to the arrival of William of Normandy, remained dominant. After the Norman Conquest, the territories of the Kingdom of Sussex were divided up by William the Conqueror amongst several of his leading nobles.

SUTHERLAND. This extreme north-westerly county of Scotland has an area of 1,207,914 acres and a population in 1931 of 16,100.

Physical Features. Throughout Sutherland there are thousands of acres of wild and barren moorland, heather moors and uplands of rank grass. In places the mountains reach 3000 ft., rising abruptly from valleys little above sea level. The coast on both the north and the west is deeply indented with countless bays and many lochs running far inland. It is rugged and precipitous throughout, and rocky islands are frequent. Roads are few and bad. The population is chiefly confined to the coastal district, whilst the interior is by far the most lonely part of the British Isles. Inland the lochs are in many cases fifteen or more miles long; in one case, the Dornoch Firth, Loch Shinn and Loch More practically divide the county into two parts.

There are no distinct ranges of hills as in the highlands proper, but disjointed chains of eminences stretching from north-west to south-east. The highest point is Ben More (3273 ft.). Ben Hope (3040 ft.), in the north, is another notable peak.

The rivers are swift and short, rising in the mountains and flowing as mountain torrents into the lochs. The most important is the Oykel, the valley of which divides Sutherland from Ross and Cromarty in the south. It rises in Ben More and flows for a course of 30 miles into Dornoch Firth. Further east the Ullie runs a parallel course, entering the sea near the boundary of Caithness. The largest loch is Loch Shinn with a total length of more than 20 miles. Of history prior to the Norse invasions of the ninth and tenth

centuries there is no trace except stone monuments. Sepulchral cairns testify to Neolithic inhabitation, and there is similar evidence of a later civilization, including the famous Celtic island-dwellings in Lochs Migdale and Doulay. But circles are common, one of the finest being on Cambusmore Hill. Later Celtic work is represented by Celtic stone crosses of various dates. By far the most remarkable is the Farrstone in the parish of that name.

History. In the ninth century, Norsemen invaded the county on the south-east and east from Scandinavia. Traces of their influence remain in place-names and certain local customs. The name of the county itself is due to them. It is derived from the Norse *Sudrland*, meaning Southland. Throughout the Norman period and later, Scandinavian influence remained predominant, and the so-called Earl's Cross is a monument of a traditional battle against the Norsemen in the latter part of the thirteenth century. The Earls of Sutherland obtained great power towards the end of the thirteenth and fourteenth centuries, but the title applied only to the south-eastern portion of the county, the remainder continuing Celtic in race and government. The first real attempt at constitutional government was in the sixteenth century when a court was set up at Dornoch. In the seventeenth century the earldom of Sutherland became a county.

Agriculture and Industries. The nature of the county is such that agriculture on a large scale is impossible, and only about 20,000 acres are under cultivation. Of this most is occupied by oats and barley. Part of the arable land is being turned back into permanent pasture, and stock-raising is carried on successfully in the valleys, while there are scattered flocks of sheep in the highland areas. Nearly half a million acres have been converted into deer forests. The principal trade is fishing and minor occupations connected with agriculture. One small coal mine exists at Brora. Building-stone is quarried.

Chief Towns. The county town and the only burgh is Dornoch, with a population in 1931 of 725. It was incorporated in 1620 and has become a fashionable watering-place. The ruins of the Bishop's Palace date from the thirteenth century, and another object of interest is the Witches' Stone, thought to be a prehistoric monolith.

SUTLEJ, RIVER. The most southerly of the five great rivers of the Punjab, in India, and the largest tributary of the Indus (which see).

SUTTEE, *sut le'*. A variation of the Sanskrit word *sati*, meaning "good wife," and the name given to the practice, formerly common among all the Hindus, of burning the widow on the funeral pyre of her deceased husband. If the husband died away from home, she was burnt on the pyre alone. The custom is not enjoined in the Vedas, but it seems to be of great antiquity, for when Alexander the Great visited India about 327 B.C. he encountered it.

In theory, the widow was always willing to sacrifice herself; in practice, compulsion was often used, but one of the emperors in the seventeenth century forbade thereafter all but voluntary immolations.



FARM IN SUTHERLAND
Photo: Taylor

The British were not able until 1829 actually to prevent suttee, although taking vigorous steps to limit its practice. It is possible that it still sometimes occurs in isolated communities, although aiding and abetting it is now a penal offence. See INDIA.

SU'ZERAIN. See FEUDAL SYSTEM.

SVALBARD, *svahl' bard*. A Norwegian territory of which Spitsbergen is a part. See SPITSBERGEN.

SWAHILI, *suah he' ie*. A branch of the Bantu tribe, whose language is a native *lingua franca* in East Africa.

SWALLOW. The common swallow is known best as a harbinger of summer, not only in Britain, but also in most European countries. The first arrivals in any number appear early in April.

The swallow comes from its winter quarters in South Africa to Europe for the breeding season. It was only discovered within comparatively recent times that the swallow spent the winter south of the Equator. At one time it was thought that they hibernated in the sea.

There are many species in the swallow family and they have a very cosmopolitan distribution. They are all small birds and spend most of their life on the wing seeking insects. The wings are long and pointed,



SWALLOW AT NEST
Photo E. J. Hoshing

and highly specialized for agile flying, but the legs are small and weak, as they are rarely used.

The swallows and martens are related, but the swallow can be distinguished by its more deeply forked tail and by the fact that



BLACK SWAN
Photo - Wide World

the entire underparts are not white. The marten has a white rump.

Scientific Name. The swallow is of the family *Hirundinidae*. The common swallow is *Hirundo rustica*.

SWALLOW-HOLES. Holes formed by the solvent action of rain water in the surface of many chalk and limestone areas.

Water collecting in any small depression widens the joints in the rocks below, and a funnel-shaped cavity or swallow-hole is the final result. Streams or even rivers may disappear underground through swallow-holes, to reappear at some lower level.

SWAN. A large water-bird related to the ducks. Swans have a very wide distribution, being found in Europe, Asia, North and South America, and in Australia. Three species are found in Britain, the whooper and the Bewick's swan being part of the natural fauna, the other, the mute swan, being a semi-domestic form introduced in very early times and now quite established in a wild state.

The common wild swan is the whooper, or whistling swan, which breeds in northern latitudes—Iceland, Lapland, etc.—and is a winter visitor to Britain. It is very similar in size to the better-known mute swan, but it can be distinguished by the bill, which is yellow with a black tip. Its name, whistling swan, arising from the fact that it has a whistling note and is therefore distinct from the mute swan, which is silent.

Bewick's swan is much smaller than the whooper; it also has distinguishing characters in the colour of its bill. This swan breeds in Arctic Europe and is quite a common winter visitor to northern Britain, particularly the islands of the north-west.

The mute swan, now common throughout



SWANS AND CYGNETS
Photo I. & U.

the country but practically the only one found in southern England, is said to have been introduced during the Crusades. It is a native of south-west Asia and south-east Europe, but at the present day mute swans

are found all over Europe in a state of semi-domestication.

At one time it was so popular, partly because of its food value, that it was protected as a royal bird, and ownership could only be obtained by special licence from the Crown. The swans under any particular ownership had to have a special mark on the bill, and there is an interesting heraldry of swan-marks.

The marking of swans got the name of *swan-upping*. The male and female swan are sometimes called a *cob* and a *pen*.

One of the largest swanneries in Great Britain is on the Dorset coast, at Chesil Bank. But even there the number of birds has decreased considerably.

Another interesting swan is the black swan of Australia. The cygnets are light in colour.

SWANSEA. This County Borough of Glamorganshire, Wales, is the nearest Atlantic port to London, from which city it is 191 miles by rail from Paddington. It is served both the L.M.S.R. and G.W.R. At the 1931 census the population was 164,825. It is the port for the anthracite coalfield of the United Kingdom, and in addition to coal its natural resources include limestone, silica, brick earth, shales, sand, and sandstone. While the eastern and northern sides are almost entirely industrial, the western side of the town is a popular holiday resort. There are ruins of a castle built in the middle of the fourteenth century. Notable buildings include the University College, one of the colleges constituting the University of Wales; the Royal Institution, containing a museum; the Glynn Vivian Art Gallery; and the parish church, which includes remains of a fifteenth-century building. In Norman times, Swansea was the scene of many conflicts with the Welsh, but the town made steady progress under various trading charters. Its first charter was granted in the twelfth century. It is the centre of the tinplate trade, and one of Great Britain's chief coal and oil ports. Oil refining and the smelting of metals are other important industries.

SWARAJ, *swah' raj*, from *swa* (own or self) and *rajya* (rule or government). Originally used to indicate strong will or self-mastery. During the last thirty years it has been a prominent political word in relation to the government of India. The leaders of the Swaraj movement have been reluctant to give, and evasive in indicating, its precise meaning. Mr. Dadabhai Naoroji, an Indian who for some time represented Battersea in the House of Commons, described Swaraj to the Indian National Assembly in Calcutta, in 1901, as the right

of India to self-government, kindred to that of the United Kingdom or of the Colonies which have now reached Dominion status. It became later generally understood as the equivalent of Dominion Home Rule; and, in 1907, by a judicial decision in the Calcutta High Court, it was defined thus: "It may mean, as is now well understood, government by the people themselves under the King and under British sovereignty." Mr. K. Gandhi took the word as the title of his political party, which engaged in an agitation in the form of passive resistance to the Rowlatt Act, a legislative measure intended to strengthen the hands of the Government of India in suppressing revolutionary crimes. Gandhi's movement included a boycott of the courts and the Government schools, the resignation of titles and offices under the Government of India, abstention from elections, and other acts. His programme was adopted by the Indian National Congress in 1920. Nevertheless the aims of the movement were not clearly defined. Mr. Gandhi has variously described Swaraj as "Dominion Home Rule," the "universal employment of the spinning wheel," as "Parliamentary Government either within or without the movement," and as "the triumph of the Khalifat party." In December, 1927, the Indian National Congress—then the Swaraj party—demanded the complete independence of India. See GANDHI.

SWASTIKA, *swos' tik a*. An ancient sign or symbol later used as an emblem of good luck. It has been found in Byzantine architecture, and as an ornament and a symbol of religious import it was used by the North American Indians. It has also been noted on Buddhist inscriptions, Celtic monuments, and Greek coins. It is shaped like a right-angled cross, with short upright extensions forming right angles on the long perpendicular and horizontal lines forming the cross. It may have represented the power or rays of the sun, or the flashes of lightning. Recently it has come into prominence as the emblem on the German national flag. The swastika here is the right-handed variety, standing upon one extremity, and is essentially the symbol of the "Aryan" race and of anti-Semitism.

SWAZILAND, *swah' zi land*. A British protectorate situated at the south-eastern corner of the Transvaal, South Africa. Politically, it is not a part of the Union of South Africa, as authority over Swaziland was transferred from the governor of the Transvaal to the British High Commissioner for South Africa, in 1906. The protectorate has an area of 6704 sq. miles; the estimated population in 1934 was 126,550, including 2830 Europeans. There are four European

villages. Mbabane, at an altitude of 3809 ft., is the seat of government.

SWEARING. See OATH.

SWEAT. See PERSPIRATION.

SWEDEN. A kingdom of Northern Europe, occupying the eastern and larger portion of the Scandinavian Peninsula, with an area of 173,349 sq. miles. About one-tenth of the total area is water. The island of Gottland (which see) in the Baltic is Swedish.

The People. The Swedes are mainly of Nordic descent, tall and fair.

The population (1931) was 6,211,566 (1934 estimate, 6,233,090). With the exception of 30,000 Finns, 7100 Lapps, and a few

Runeberg, the modern spirit of realism swept over Sweden. The greatest writers of the modern period include Strindberg, the radical dramatist, and Selma Lagerlöf, a novelist, who won the Nobel prize for literature in 1909.

Education. Illiteracy is almost unknown in Sweden. Education is free and compulsory, and an excellent school system is maintained under government supervision. There are many special schools. There are two universities, the University of Uppsala, founded in 1477, and the University of Lund, founded in 1668. The Caroline Medico-Surgical Institute at Stockholm is also a national university. In addition, there are two private universities at Stockholm and Gothenburg.

Religion. Most of the Swedish people are members of the Lutheran Church, which is the State Church. With the exception of the Mormons, who were expelled in 1912, all denominations are tolerated. Among the dissenters, the Baptists and Methodists are most numerous.

The Cities. Stockholm, the capital is described in these volumes under its title. Other cities of importance are described below.

Gothenburg, (official Swedish spelling, *Goteborg*), next to Stockholm is the largest and most important city, and the country's chief port on the Kattegat. It is connected by the Göta Canal with Stockholm. The chief industries are cotton-spinning, saw-milling, shipbuilding, and the manufacture of iron and steel. The harbour, which is now the largest in Sweden, is rarely blocked with ice. Gothenburg handles the largest amount of tonnage in foreign trade. The city has technical, nautical, and commercial schools. Population, 255,386 (1935).

Malmö is a seaport lying on the opposite shore of the Sound from Copenhagen, in Denmark. It was formerly strongly fortified, but the only fortification now remaining is the citadel where the Earl of Bothwell, husband of Mary Queen of Scots, was imprisoned from 1567 to 1573. The town exports grain, flour, gloves, chocolate, etc. Population, 138,764 (1935).

Physical Features. The greater part of Sweden is the eastern slope of the Scandinavian plateau built of old crystalline rocks. To this are added certain lowland areas along the Gulf of Bothnia and, in the south, wide plains and low uplands. Highland Sweden, called Norrland, occupies half the area of the country, and is in the main a rugged region scored with many rivers and

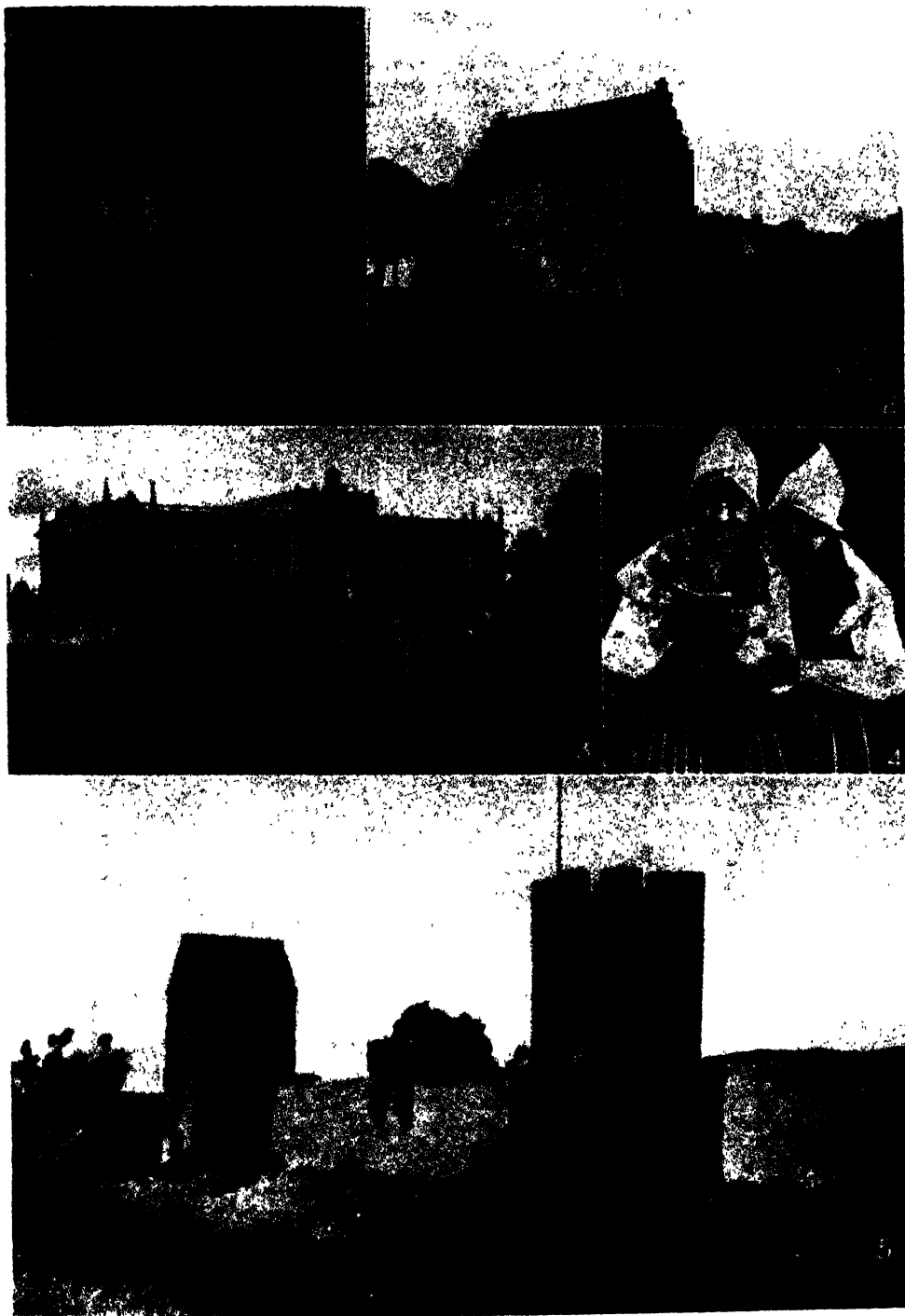


MIDNIGHT SUN IN SWEDISH LAPLAND
Photo ORON

thousand foreigners, the entire population is Scandinavian. A large proportion of the inhabitants live in the rural districts.

Language. The Swedish language is a North-Germanic tongue, and it much resembles the Danish. It has, however, a more delicate and musical accent than the Danish.

Literature. Sweden has produced some of the world's greatest thinkers and literary men, among whom are Bellman, the national poet, Swedenborg, a religious philosopher, and Linnaeus the naturalist. Swedish literature had its beginning in the written laws of the thirteenth century, and the earliest verse consisted of the popular ballad and folks song of the fifteenth century. The Renaissance and Reformation, which so greatly influenced the literature of continental Europe and England, were scarcely felt in Sweden and Norway. Swedish literature reached its height during the reign of Gustavus III, himself a writer and great patron of learning. This was the age of Bellman, Swedenborg, and Linnaeus. At the close of the nineteenth century, which produced the poets Tegner, Stagnelius, and



SWEDEN

1. Typical South Swedish cottage and peasant.
2. A sixteenth-century fortified manor-house, Skone.
3. Parliament Building, Stockholm.
4. Girls of Leksand, Central Sweden
5. Medieval walls of Visby, Gottland.

Photos. Norddeutscher Lloyd; ORO; Swedish Travel Bureau

sloping down from heights of 6000 ft. or more lying on the Norwegian frontier. The greatest heights, Sarektjåkko (6971 ft.) and Kebnekaise (6965 ft.) are in Swedish Lapland. Most of Norrland has a stony, unproductive surface, except the low coastal strip which has some fertility. Central and south Sweden, from the Skagerrak to the Baltic, is a lowland area of fertile soils with many great lakes of which the largest are Vänern (2141 sq. miles), Vättern (733 sq. miles) and Mälaren (444 sq. miles).

vessels can continue about another 186 miles to the Baltic.

Climate. The country occupies the leeward section of the Scandinavian Peninsula, and no part of Sweden has so equable a climate as that of Southern Norway, where the seasons are tempered by the Atlantic winds. There is a wide difference between the annual temperature of the northern part of the country, which lies within the Arctic Circle, and that of Skåne, which is 900 miles farther south. Winters in the north last nine



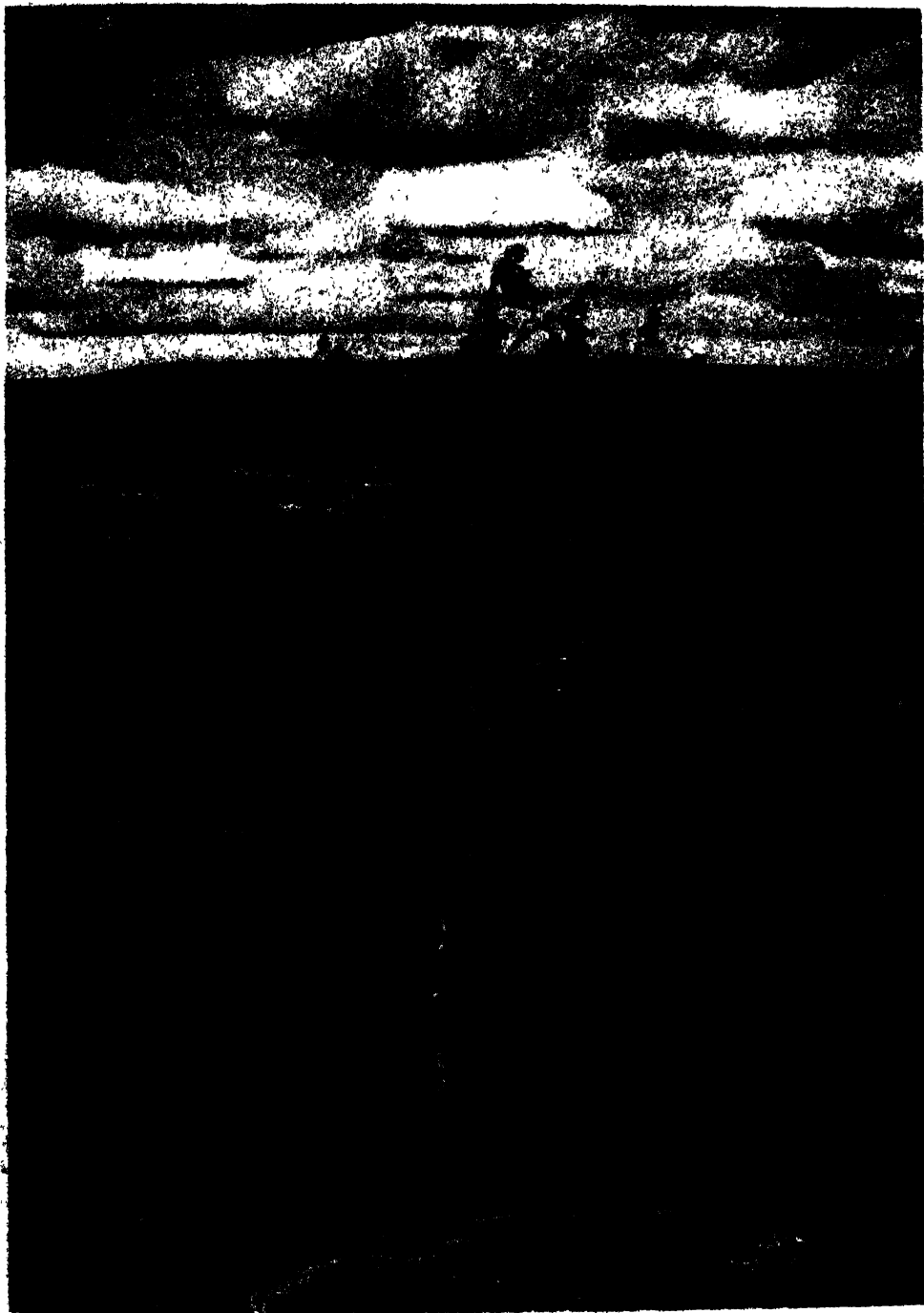
SANDHAMN, STOCKHOLM ARCHIPELAGO

Photo: Swedish Travel Bureau

The extreme south part, known as Skåne, is the lowest, most level and most fertile. The Småland highlands are an isolated area of old rocks rising to 1100 ft. and forming an island of infertility in the heart of the plains. There are no ice sheets in Sweden and only a few small glaciers, all in Lapland, but the whole land bears traces of former glaciation. Rivers are many and often long, with numerous rapids but few striking waterfalls. Their seasonal variations in flow are great, especially in the north, and they all freeze in winter for periods of three to six months. Few are navigable beyond their estuaries. In Central Sweden short canals linking lake navigation and several larger canals (as the Göta canal) have been built. The Trollhättan canal along the canalized Göta river allows small sea-going vessels to reach Lake Vänern, a distance of 34 miles inland. Small

months, and in the south they are only two months shorter. Spring and autumn are very short, and in some regions are lacking altogether. At Stockholm the average temperature for July is 62°, and for January 27°. The rainfall averages about 20 in. It is heaviest during August, and the greatest amount falls in the south. In the northern part of the country, the precipitation rarely exceeds 13 in.

Resources. *Agriculture* Sweden has always been predominantly an agricultural country, but the recent development of manufacturing and other industries has divided the population equally between farmers and factory-workers. The farms are generally small, ranging from five to fifty acres, and are owned by independent farmers. Skåne and the Baltic islands are the most productive regions. The principal



VIEW OVER LAKE VÄGSJÖN IN SWEDISH LAPPLAND

Photo: Swedish Travel Bureau

(C.2236)

crops are hay and fodder-roots, potatoes, sugar-beet, oats, barley, and wheat. Barley is the only cereal raised in the north, and the cultivation of sugar-beets is largely confined to Skåne and Gottland.

Southern Sweden is also a rich pastoral region, where cattle-raising and the herding of swine are important; quantities of dairy products are exported to England. Goats are herded on the hilly slopes, and even in the far north, herds of reindeer find sufficient grazing to keep the nomadic Lapps in food and clothing.

Forests. More than one-half of Sweden is timber land, and the extensive forests constitute the main natural wealth of the country. The uplands and mountains are clothed with dense forests of pine, spruce, birch, and mountain ash; thick groves of oak border the lowland lakes, and beech woods separate the cultivated fields of Skåne.

Fisheries. The calm waters of the sea inlets are excellent fishing grounds, and sea fishing has long been one of Sweden's principal industries. Herring is the most important catch, and there are large salmon fisheries in the mouths of the northern rivers.

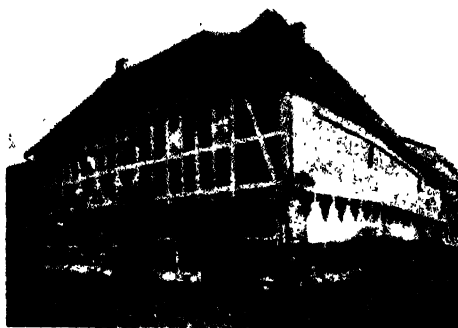
Mining. Sweden's mines form one of its chief sources of wealth. The northern and midland regions are especially rich in iron. Swedish iron ore is noted for its purity. Millions of tons are exported annually. Copper, formerly mined extensively in Falun, has fallen off considerably in production. Deposits of silver, coal, lead, zinc, manganese, and sulphur pyrites are found in various parts of the country. Only half a million tons of coal are raised every year.

Manufactures. The vast power furnished by the south-western rivers is being utilized for the development of large manufacturing industries. Factories are scattered throughout the small towns and rural districts. Lumber and timber products, including furniture and paper, are important manufactures. There are iron-smelting plants and steel foundries in the midland districts. Eskilstuna is a noted steel centre. Porcelain and glass factories, flour and woollen mills, sugar refineries, leather and rubber plants, chemical factories, and electric and gas plants are also important. Trollhättan, Norrköping, Stockholm, and Gothenburg are the chief manufacturing cities.

Transport and Commerce. Besides 40,440 (1934) miles of roads and 10,255 (1934) miles of railway, Sweden has 2500 miles of inland waterway afforded by the many rivers, canals, and lakes. Railways between Swedish cities and Russian ports were opened in 1915, and a railway now encircles the Gulf of Bothnia, affording transport from Stock-

holm to Leningrad. The Lapland Railway gives access from the great iron mines to Narvik in Norway, an ice-free port.

The commerce of Sweden is extensive for a country of its size. It is mainly with Great Britain, Germany, and the United States. The chief imports are coal, metal goods, machinery, raw textiles, and foodstuffs, and the principal exports are timber products, paper, iron, livestock, and dairy products. The chief ports are at Gothenburg and Stockholm, but Malmö and Helsingborg are also important. The timber ports of the Gulf of Bothnia are closed by ice from



TIMBERED HOUSE AT YSTAD
Photo: Swedish Travel Bureau

December to April or May. Many other ports may be obstructed for a few weeks.

Government. Sweden is a constitutional monarchy. The Constitution was adopted in 1809, and has been several times amended and modified. The executive power is vested in the king, who must be a member of the Lutheran Church. He is assisted by an administrative Council of State. The right to make laws is vested in the Diet, which consists of two chambers. In the upper chamber there are 150 members, elected for eight years by the municipal and provincial councils, or *landstings*. The second chamber consists of 230 members, elected for four years by universal suffrage.

Local Government. There is a high governor at Stockholm and a prefect, nominated by the king, in each of the twenty-four provinces. The communal assemblies and city councils decide questions of local administration. Religious affairs and elementary education are controlled by parish assemblies. Liquor traffic is rigidly controlled by the government. Spirits may be sold only by responsible societies, and the profits go to the municipalities.

History. Much of Sweden's history before 1000 A.D. is legendary. Christianity was introduced in the middle of the ninth

century, but was not fully established until the eleventh century, during the reign of Olaf, who defeated Norway and made Sweden the mightiest kingdom in the north. During the next 200 years, Sweden's history is a story of the warfare between the Swedes in the northern part of the country and the Goths in the south, and between both of these peoples and the Danes. About the middle of the twelfth century, the government and the Church were organized, and under the kings Sverker, Eric IV, and

new territory was acquired, and for some years Sweden was recognized as a great power, but in 1675 its forces were completely defeated by Frederick William of Brandenburg, its sea power was lost, and ruin was only averted by the treaty of peace.

The eyes of all Europe were again turned on Sweden during the reign of Charles XII, who invaded Denmark, Poland, Russia, and Norway. Following his death, Sweden was weakened by political struggles, and even Gustavus III (1771-1792), who wiped out



NEAR VUORVA, SWEDISH LAPLAND
Photo Swedish Travel Bureau

Charles VII, Sweden's political and economic development began.

In 1397, by the Union of Kalmar, Queen Margaret of Denmark and Norway united Sweden with the other two Scandinavian countries under one rule. The Swedes were restive under the predominance of Denmark, and in 1523 they broke away from the union and elected Gustavus Vasa king of Sweden. During his reign the Reformation spread to Sweden, and Lutheranism was made the State religion.

Under Gustavus Adolphus (1611-1632), Sweden became one of the greatest European military powers and commercial countries. This king's ambition for territorial expansion and his Protestant faith drew him into the war in Germany. The policy of Gustavus Adolphus was continued after his death;

the factions and increased the royal power, was unable to restore Sweden to its former prosperity.

Charles XIII (1809-1818), having no heir, chose Bernadotte, one of Napoleon's marshals, as crown prince. Bernadotte joined the allied powers in the final conflict with Napoleon, and, as a reward for this support, Norway in 1814 was transferred to Sweden from Denmark, for the latter country had united with Napoleon. Bernadotte came to the throne in 1818 as Charles XIV.

In 1905 King Oscar II refused to give Norway a separate consular service. Norway then declared its independence. King Gustaf V succeeded to the throne in 1907.

Notwithstanding its neutrality during the World War, Sweden suffered many hardships, for its shipping, when not imperilled by the

mines and submarines of the North Sea, was cut off entirely by blockades.

Since the war, industry has made great progress, and recent social and economic reforms have placed Sweden among the foremost nations of the world. Arbitration councils were established with the other Scandinavian powers by 1925.

Sweden, like other countries, was affected by the world-wide economic depression, and in 1931 it went off the gold standard. The financial situation became critical in 1932 with the death of Ivar Kreuger, head of an international match trust, whose vast financial organization was found to be on the verge of bankruptcy. The country has, however, shown remarkable recuperative powers.

SWEDENBORGIANS, *sive den bor' ji anz*. The religious sect that accepts the teachings of Emanuel Swedenborg. Between 1782 and 1788, his followers organized, in London, the New Church, or the New Jerusalem Church. Their belief, as set forth in Swedenborg's writings, regards the universe as one whole, the outward world being the counterpart of the inner and spiritual. Beneath the literal meaning of the Bible is the spiritual meaning, which is open to those who have inner discernment. Justification is not attained by faith alone, but whoever fears God and works righteously shall be saved. God is one, and the real Trinity is in Christ. The last judgment has already taken place, and the New Jerusalem has descended in the form of the New Church. There is no physical resurrection, but at death men's eyes are opened to the spiritual world, of which they are already a part. They are drawn to heaven or hell by their own affinities.

Emanuel Swedenborg (1688-1772). Scientist, philosopher, and divine, born in Sweden, the son of a Lutheran bishop. Intended for a teaching career, he studied the sciences in England, and later wrote the first algebra book published in Sweden. In 1745 he turned to religion and developed the system now held by the Swedenborgians. Swedenborg never preached, and had no intention of organizing a new religious sect, for he believed that members of any church might benefit from the teachings

of the New Church. It was not until ten years after his death that any attempt was made toward organization.

SWEDE TURNIP. See **TURNIP**.

SWEEPSTAKE. See **LOTTERY**.

SWEET ALYSSUM, *al' is um*. A low, spreading plant of the mustard family, bearing clusters of tiny white flowers on four-sided stems. It is a hardy annual, blooming until late in the autumn, and is often used as an edging for borders and



SWEET PEA
Photo: Carters

flower beds. The perennial alyssum, whose best-known variety has bright yellow flowers, is a favourite plant for rockeries.

Scientific Names. Sweet alyssum belongs to the family *Cruciferae*. Its botanical name is *Alyssum maritimum*. Yellow alyssum is *A. sativum*.

SWEETBREADS. Certain glands in the calf which are esteemed as an appetizing food. There are two kinds, *neck sweetbread* and *stomach sweetbread*, the first being the thymus gland, and the second the pancreas. The latter is the more easily digested, and can be assimilated in less than half the time required for an equal amount of beefsteak.

SWEETBRIAR. Fragrant British wild rose, often cultivated, or grown as a hedge, for its scented flowers and leaves. It is *Rosa rubiginosa*.

SWEET CICELY, *sis' e le*, or *sis' le*, also known as **SWEET CHERVIL**. A perennial herb of the parsley family. Its sweetly fragrant leaves, reminiscent of anise, are sometimes used as a seasoning for soups and salads.



EMANUEL SWEDENBORG
Photo: Brown Bros.



SWEET WILLIAM
Photo: Carters

Roots and seeds are also used for flavouring. The plant can be successfully grown in gardens in England. It reaches a height of about 3 ft., and has downy grey leaves and small white flowers.

Scientific Name. Sweet cicely belongs to the family *Apiaceae* (or *Umbelliferae*). Its botanical name is *Myrrhis odorata*.

SWEET PEA. A garden plant belonging to the same family as the edible pea. The flowers are blue, red, purple, pink, and white, and in shape suggest the butterfly. In 1699, seeds of a white variety were sent to England from Sicily, and since that time numerous varieties have been developed in various parts of the world. In some varieties, the flower petals are smooth; in others, they are wavy. There are two general types—the tall-growing and the dwarf. The former, which is the more popular, produces a rough hairy stem that climbs by tendrils and needs support.

Successful cultivation of the sweet pea requires a rich, well-drained soil, plenty of sunshine, and free circulation of air.

Scientific Name. Sweet peas belong to the family *Leguminosae*. The common garden species is *Lathyrus odoratus*.

SWEET POTATO. A plant with long, creeping stems and heart-shaped leaves; cultivated for its sweet, edible roots, whose

resemblance to the common potato gave the plant its name. It is native to America, but has been grown with success in many warm countries.

Scientific Name. The sweet potato belongs to the family *Convolvulaceae*. Its botanical name is *Ipomoea batatas*.

SWEETS. See CONFECTIONERY.

SWEET WILLIAM. A cultivated variety of the pink. It is distinguished by the fact that each stem bears its flowers in a flat cluster. The plant is a biennial and is notable for its sweet scent.

SWEYN, KING OF ENGLAND AND DENMARK (d. 1014). He ascended the throne of Denmark in 986, and in alliance with Olaf, King of Norway, twice invaded England. On the first occasion (994) he was bought off by Ethelred the Unready. The second invasion was undertaken in revenge for the massacre of the Danes on St. Brice's Day (1002), and this time a large part of the country was overrun and ravaged. In 1013 Sweyn, accompanied by his son Cnut, made a third assault, which resulted in a complete conquest. His reign, however, was short, for in the following year he died, leaving Cnut to carry on the conflict.

SWIFT. A bird very similar in habits and appearance to the swallow, though they are probably not related. The British swift is much larger than the common swallow, and is of a uniform dark colour. Actually the surest distinction between swift and swallow is in the number of tail-feathers, the swift



CHIMNEY SWIFT
Photo: Visual Education Service

having ten and the swallow twelve; also the four toes of the swift are pointed forward, while in the swallow the toes are normal, three in front and one behind.

Like the swallow, the swift is only a summer visitor, but it arrives some weeks later—about the end of April. Nesting habits are very similar to those of the swallow.

SWIFT, JONATHAN (1667-1745). An English satirist and clergyman, born in Dublin. He was unusually advanced as a child—could spell at three, and at five could read any chapter in the Bible. At the Kilkenny School, and later at Trinity College, Dublin, his course of study was most irregular. History and poetry appealed to him, and

he read them greedily, but for the set course of study he had nothing but scorn.

At twenty-one he became secretary to Sir William Temple, of Moor Park, Surrey. In 1694, to gain independence, he accepted a small parish in the Irish Church, but in a short time he returned to the Temple household. Here he remained until Sir William's death.

In Temple's family

he became acquainted with Esther Johnson, whom he made famous as the "Stella" of his writings.

In 1699 Swift was made vicar of Laracor and Rathbeggan in Ireland; and in 1704 published his *Tale of a Tub*, a humorous and forceful satire on insincerity and pedantry in literature and in theology. In the decade that followed, he became a conspicuous figure in politics. Beginning as a Whig, he became so opposed to the principles of his party that in 1710 he turned from it entirely, making plain the change by undertaking to conduct the *Tory Examiner*. In 1714 he shared the Tory loss of power, and was forced to content himself with an appointment to the deanery of St. Patrick's, Dublin.

During his residence in Ireland, previous to 1710, Swift had urged Miss Johnson and her friend Mrs. Dingley to make their home near him, and thus he enjoyed a continuance of his early friendship. While he was in England, from 1710 to 1713, he wrote the letters that compose the *Journal to Stella*, a work of deep biographical interest. A friendship with a Miss Hester Vanhomrigh, which

had an unhappy ending in 1723, further embittered Swift on his return to Ireland.

In the year following this unfortunate affair, Swift won the lasting esteem of the Irish people by issuing the *Drapier's Letters*, in which he vigorously opposed the granting of a patent for copper coinage in Ireland. In 1726 appeared his *Gulliver's Travels*, a bitter, though often amusing, satire on the human race. In 1742 the fate that he had long dreaded came upon him, and he became insane.

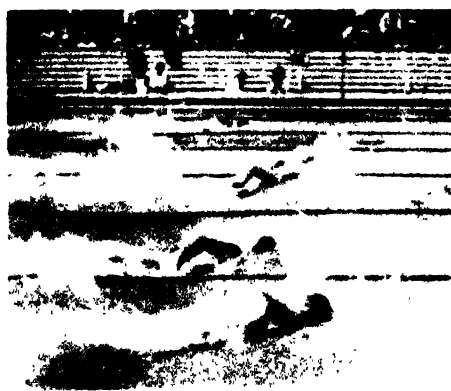
Besides the books mentioned above, Swift published a good deal of miscellaneous work in verse and prose, nearly all satirical or humorous. Much of this work appeared in the three volumes of *Miscellanies* which he published with Pope in 1727. His satirical writings range from light-hearted jokes, such as his literary banter on Partridge the Astrologer, to such bitterly ironical essays as his *Modest Proposal* or his morose *Verses on the Death of Dr. Swift*. A notable work of his early years was *The Battle of the Books* (1704). Among his political writings were *The Conduct of the Allies* (1712), *The Barrier Treaty* (1712), and *The Public Spirit of the Whigs* (1714), all of which were widely read in his own day. It is as a satirist, however, that Swift is remembered, and through *Gulliver's Travels* that his satire is known to most people to-day.

SWIMMING is a recreation which combines all-round exercise with immense value in self-preservation and life-saving.

This sport, once confidence has been gained, is usually easily and quickly acquired



JONATHAN SWIFT



FREESTYLE SWIMMING RACE
Photo Fox

Inhalation is perhaps the most difficult part for the learner, who must acquire a well-regulated action of taking in air. Exhalation must be made forcibly but methodically.

There are many varieties of swimming strokes, such as breast, back, crawl, trudgeon, side, etc.; but the breast-stroke is usually regarded as the foundation of swimming instruction. Proper limb action is essential, and strokes must never be hurried; quickened movement affects respiration and rapidly brings on fatigue. The actions of arms and legs are best learnt separately. The arms should be bent, with elbows in; the hands held flat near the surface of the water and almost touching the chin. The complete arm movement is: 1. Stretch forward. 2. When fully extended, turn palms outwards. 3. Make as wide a sweep as possible until the arms are in a line with the shoulders. 4. Draw up ready for next stroke.

The legs, which provide the chief propelling power, should be drawn up when the arms are, then kicked out widely and swept forcibly together, the last movement driving out a "wedge" of water which pushes the body forward. The body should be in a straight line when the legs come together. The beginner should practise in shallow water, about waist deep. The breast-stroke and back-stroke are necessary to life-saving. For speed and endurance the crawl is mainly employed. In the crawl the body is largely on top of the water, face downward and horizontal to lessen resistance. The movements are an arm "cycle" and leg thrash. The legs, held straight, but not rigid, make a simple up-and-down movement, the toes pointing slightly inwards. With hands cupped, the arms are driven down under the body and up to the surface, the thumbs brushing past the thighs. On emerging, the arms are bent in recovery before making the next stroke. As the arms dip alternately into the water, the head

must be turned to the side for breathing. See DIVING.

SWINBURNE,

ALGERNON CHARLES (1837-1909) English poet and critic. In 1860, just after leaving Oxford, he published two poetic dramas, *The Queen Mother* and *Rosamond*, which have considerable dramatic power and are written in finely-sounding blank verse.

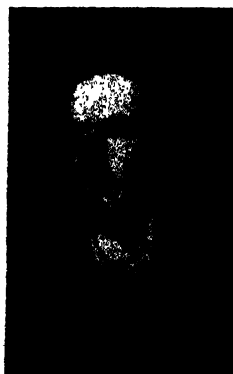
His amazing metrical ingenuity in the lyrical poems is admirable. But the ordinary adult person soon

grows tired of Swinburne's endless voluptuousness and meaningless harmonies. He is the poet of youth and is best read by young lovers of poetry. Other works include *Atalanta in Corydon* (1865), *Bohewell* (1874), *Study of Shakespeares* (1879), *Mary Stuart* (1881), *Tristram of Lyonesse* (1882), *Marino Faliero* (1885) and *Locrine* (1887).

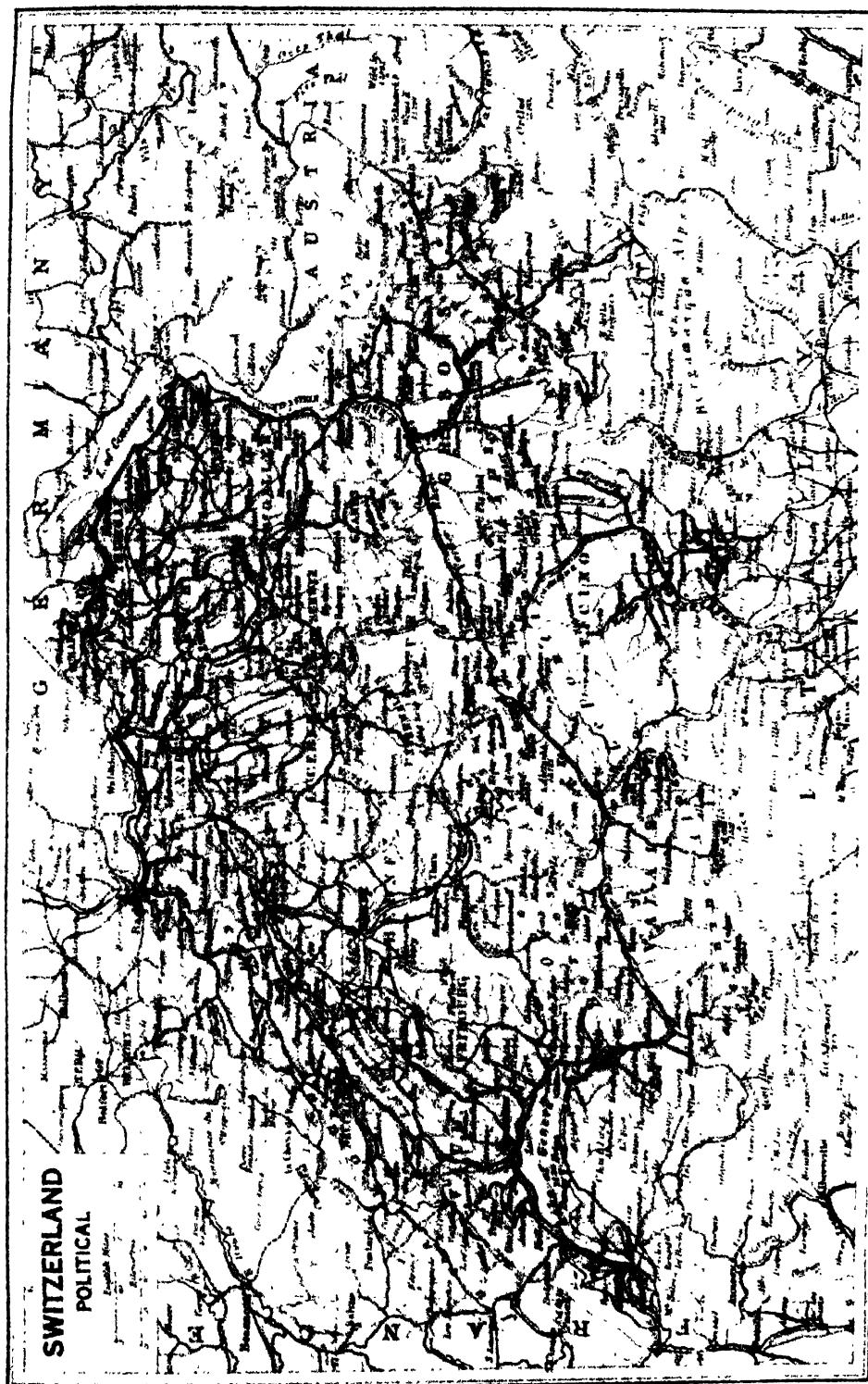
SWINDON. A Municipal Borough of Wiltshire with an area of 6019 acres and a population of 62,407 in 1931. The modern town dates from the establishment of the G.W.R.'s factory in 1843, when the population did not exceed 2000. Since then its growth has been so rapid that by 1900 it qualified for a Charter of Incorporation. At the present time, about 12,000 persons are employed in the Company's works. The town has since attracted other industries and modern manufactures include cloth, tobacco, and heavy engineering products. Historically, old Swindon is associated with the Goddard family, who from the middle of the sixteenth century were Lords of the Manor and, at a later date, members of Parliament for the Division. It was due to one Thomas Goddard that the town's first Charter was obtained from Charles I, who established a weekly market and two annual fairs. Richard Jefferies, the writer, is associated with the town, for his early days were spent in the district of Coate. Liddington Hill, near the outskirts of the town, is crowned by an ancient British castle nearly eight acres in extent, surrounded by a well-preserved fosse.

SWINE. These form the genus *Sus* or family *Suidae*, which comprises bristle-bearing, non-ruminant mammals. Boar is the name given to the fully-grown male, and the fully-grown female is called a sow. From very early times this animal, originally wild, was tamed and bred for food. Prepared and cured in various ways, the flesh has become a popular diet in many countries. The words swine and boar have been generally dropped for the words pig or hog, although in zoology the original name is preferred. See FIG.

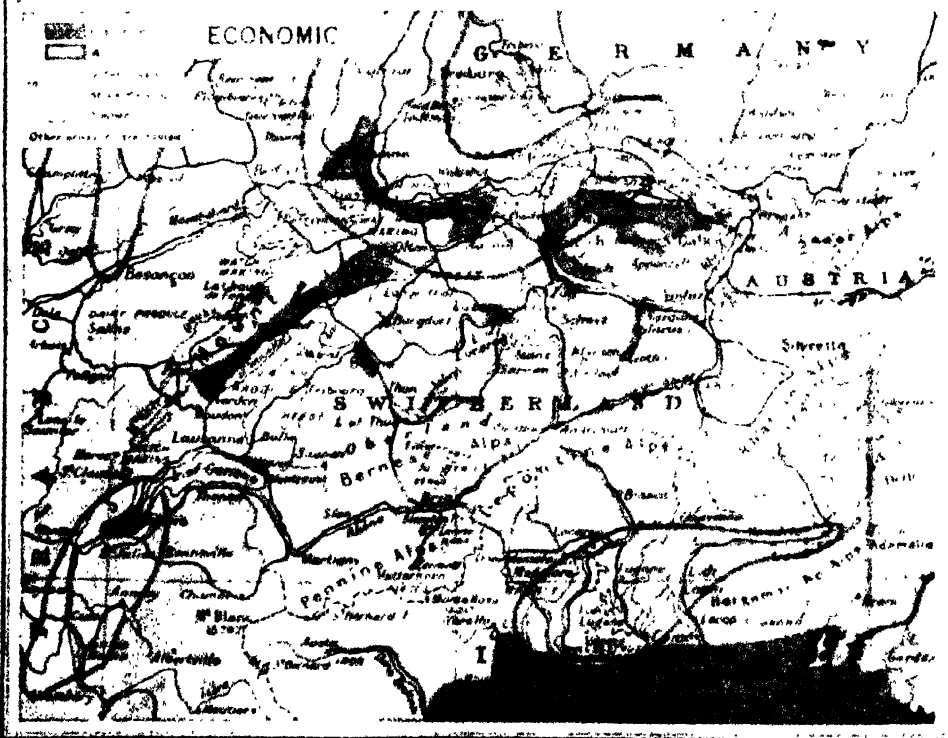
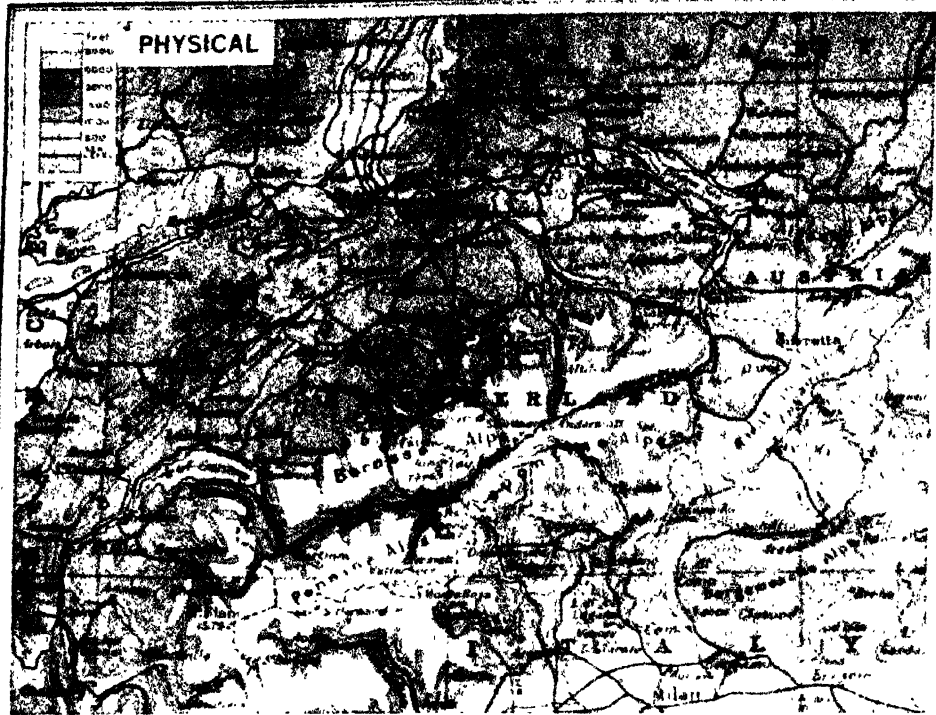
SWITHIN, SAINT. There is a legend that Swithin, bishop of Winchester, wished to be buried in the churchyard of the minster. He died in A.D. 862, and the reason he had given for the place of burial was that the "sweet rain of heaven might fall upon his grave." He was canonized later, and 15th July was fixed for the ceremony. The monks wished the body to be brought into the choir on that occasion, but they abandoned the idea because on and from 15th July it rained incessantly for forty days. From this the monks believed the saint was opposed to the removal of the body. The Saint



SWINBURNE
(National Portrait Gallery)



SWITZERLAND



Swithin of Scotland is Saint Martin of Bouillons; and of Flanders, Saint Godelieve. A Scottish rhyme runs—

St. Swithin's day, gif ye do rain, for forty days it will remain;

St. Swithin's day, an ye be fair, for forty days 'twill rain nae mair.

SWITZERLAND. One of the oldest republics in the world, with one of the most progressive and democratic of governments. Switzerland has an area of about 15,940 sq. miles. It has no sea-coast, being entirely surrounded by France, Germany, Austria, and Italy.

People. In the racial characteristics of its people, numbering in the 1930 census 4,066,400, Switzerland reveals two sharply contrasting strains—the Latin and the Teutonic. The Teutons include most of the population; the German language is spoken by the majority of inhabitants in nineteen of the twenty-five cantons, those of Central, Northern, and Eastern Switzerland. The French language is used in Geneva, Neuchâtel, Vaud, Fribourg, part of Valais, and the Bernese Jura. Italian is the language of the canton of Tessin (Ticino). The historical dialect of Romansch is still spoken by a small group (in the canton of Grisons), but is slowly declining.

Naturally, this diversity of speech, as well as the great variations in the nature of the surface of the land itself, would not tend to make a wholly united people with similar national characteristics. Switzerland has twenty-five states, or cantons, about 3000 communes, and 192 districts, which consist of groups of communes, each with its own local life and customs.

The mountains of Switzerland attract sportsmen and travellers from all over the world, and the profession of guide enlists many of the mountaineers, who offer their services for mountain-climbers.

Religion. Switzerland has complete religious liberty of conscience and creed, but the introduction of new religious orders, the establishment of new bishoprics, and the activity of religious sects whose action interferes with other creeds or endangers the state, are all restricted by the confederation. The German-speaking cantons of the central and eastern parts are Roman Catholic, those of the north and west are Protestant. The cantons of Lucerne (Luzern), Valais, Fribourg, and Bernese Jura are Roman Catholic, but the other French-speaking cantons are chiefly Protestant.

Education. Elementary education is obligatory in all of the cantons. There are many



WASSEN VILLAGE ON THE ST. GOTTHARD LINE

Looking northward down the Reuss valley.

Photo: Swiss Federal Railways



AN AERIAL VIEW OF BASEL

Photo: German State Railways

trade and technical schools. The percentage of illiteracy is very low. There are seven universities in the country, at Basel, Zürich, Bern, Geneva, Lausanne, Fribourg, and Neuchâtel. The Federal government maintains a polytechnic school at Zurich.

The Cities—

Basel, or *Bâle*, on the Rhine, on the northern border of the country, originated as a frontier post of the Romans in the fourth century. It contains many old buildings, including an ancient cathedral, founded in 1019, containing the tomb of Erasmus, and the oldest university of Switzerland, founded in 1459. Noted for over 200 years for the manufacture of silk ribbons, Basel also produces paper and aniline dyes, while tanning and brewing constitute the other industries. In 1929 the city was selected as the site of the Bank for International Settlements. Population (1933) 196,883.

BERN, or *Berne*, since 1848 the capital of the republic, situated nearly 1800 ft. above sea level and surrounded on three sides by the River Aar, has been called the finest city in Switzerland. Among its buildings are the great Gothic minster, built between 1421 and 1573; the Church of the Holy Spirit; the Federal Council buildings, or Parliament House; and the university. The city is noted for its woollens, linens, silkstuffs, stockings, watches, clocks, and toys. The population in 1933 was 147,650.

The name is taken from the German word *Bären*, meaning "bears" and was adopted, according to legend, because many bears were killed on the day the city was founded.

Geneva, officially *Genève*, at the western

end of Lake Geneva, at the outlet of the River Rhône, is distinguished as a theological, literary, scientific, and political centre. In 1536, when Geneva invited Calvin to make his home there, it became one of the greatest strongholds of Protestantism in Europe. In 1919 it was chosen as the seat of the League of Nations (which see). In 1928 a site was selected for the permanent office and conference hall of the League. A new building for the International Labour Office adjoins the League buildings. Geneva is also the headquarters of the world's Red Cross Societies.

Geneva is one of the principal entrances for tourists into Switzerland. Among its old buildings is the transitional Cathedral of St. Peter, dating from about 1120. The staple manufactures are watches, clocks, musical boxes, jewellery, gold and silver ornaments, and scientific instruments, and, in recent years, motor-cars. Population, 146,230 (1933).

Interlaken, at the western end of the Lake of Brienz, is a health resort easily accessible from Bern, and with the added advantage of fine mountain scenery. Population, 4150.

Lausanne, about half a mile from Lake Geneva, is built on and around five hills, two of which are connected by a lofty viaduct. The beautiful Gothic cathedral, built in the thirteenth century, is an imposing landmark. Close to the cathedral is a castle, built early in the fifteenth century; also nearby is the Palais de Rumine, housing the university.

The opening of the Simplon Tunnel, in 1906, added greatly to transport facilities and made the city an important industrial district. It is as an educational centre,

however, that Lausanne is most famous. Population, 96,381 (1933).

Lucerne, officially *Luzern*, on the banks of Lake Lucerne, is divided into two parts by the River Reuss—the modern section, with broad streets and great hotels, and the quaint medieval town. In the latter part are the Hofkirche, a church dating from 1506; the sixteenth-century town hall, with its collection of art and antiques; and the famous "Lion of Lucerne," a huge lion carved in solid rock in memory of the Swiss Guards massacred in defence of the Tuileries in Paris. Population 72,802 (1933). A lake-side chapel commemorates the Belgian Queen Astrid, killed in a motoring accident.

Neuchâtel lies on the banks of Lake Neuchâtel, twenty-five miles west of Bern. Among its interesting features are an abbey church, dating from the twelfth century, and the old castle of the Counts of Neuchâtel, now used as a government building. The chief industries are watchmaking and the manufacture of jewellery and electrical apparatus. Population, 66,668 (1930).

St. Moritz, in the Engadine, at an altitude of over 6000 ft., is the well-known winter

sports centre, much visited also for its chalybeate springs. Population, 3250.

Zürich, at the northern end of Lake Zurich, is the largest city of the republic. The Romanesque cathedral dates from the eleventh century. Zürich is a noted educational centre. The cantonal university, founded in 1832, is the most celebrated institution for higher learning in Switzerland, and is especially famous for its medical school. The Federal Polytechnicum, or engineering school, founded in 1855, is also here. Silk-weaving is the most important industry; cotton goods and machinery are also made. Population 333,355. (1933).

Physical Features. The snow-clad Alps and the Jura range cover about three-fourths of the whole land, making Switzerland the most mountainous country on the continent of Europe. The loftiest masses of the Alps constitute the southern and central regions of Switzerland, and the Jura Mountains form a great curve in the north-western part. Between these two mountain masses is an elevated plain, opening to the north and where most of the people live; this plateau is at an elevation of 1500 ft. to 1000 ft.



VERNAYAZ POWER STATION WITH PIPE-LINE BRINGING WATER POWER FROM THE SNOW-FIELDS

Photo Swiss Federal Railways

In the Swiss Juras there are no very lofty elevations, the highest summit, the Dôle, being a little over a mile above the sea, but the glacier-robed Alpine ranges send up many towering peaks, culminating in Monte Rosa, 15,217 ft., the Matterhorn, 14,780 ft., and the Jungfrau, 13,669 ft. The St. Gothard group of mountains is the centre of the great Alpine ranges.

Rivers and Lakes. Four rivers, draining into four different seas, make their way through Switzerland—two of them among the most important in Europe. These are the Rhine, Rhône, Ticino, and Inn.

The melting of the snow in the mountains gives rise to many torrents, and Switzerland is noted for its waterfalls. The highest of these is Staubbach, in the Lauterbrunnen Valley, a veil-like cascade which falls over 900 ft.

Of the larger lakes, or those famous for grandeur of scenery, the chief are the following—

Constance (in German *Konstanz*), lying between Switzerland, Austria, and Germany, is about 1300 ft. above the sea. It is about 10 miles long and 9 miles wide, and has an area of 263 sq. miles. A characteristic of Lake Constance which cannot be explained, except on the unsatisfactory theory of rapidly melting snows, is its occasional sudden rise and fall. In 1770 it rose, in one hour, about 24 ft. above ordinary level.

Geneva (in French *Lac Léman*, in German *Genfer See*), the largest lake in Central Europe, is partly in Switzerland and partly in France. It reaches a depth of 1015 ft., and its total area is 224 sq. miles, of which only 83 sq. miles belong to France. The River Rhône enters the lake at the east, and emerges at Geneva at the west.

Lucerne, in North-Central Switzerland, is one of the most picturesque lakes in Europe. It is roughly in the shape of a cross, with irregular, winding arms between steep, rocky cliffs. The lake is about 24 miles long and 2 miles wide, with an area of about 45 sq. miles.

Lugano, known to the Italians as *Lago Ceresio*, lies at the foot of the Alps, its surface being 899 ft. above sea level. It is situated

partly in Lombardy, Italy, and partly in the Swiss canton of Ticino. The name is derived from the town of Lugano, the only important place on its banks. The winding length of lake Lugano measures 20 miles.

Neuchâtel, the third largest lake of Switzerland, and the largest lying wholly within the country, is of historic interest as the former site of a colony of lake-dwellers (see LAKE-DWELLINGS). The lake is 24 miles long and has an area of about 92 sq. miles.

Zürich lies in a deep valley in the midst of the most charming scenery of Northern Switzerland, making it a favourite resort of tourists. The lake is crescent-shaped, and measures about 25 miles in length and from about one-half to two and one-half miles in width.

Climate, Plant and Animal Life. The variations in altitude in Switzerland cause corresponding variations in climate and in the character of the vegetable life. In the valleys and on the lower mountain slopes, oaks, beeches, pines, and firs grow. Higher



GREAT ST. BERNARD HOSPICE
Photo: Visual Education Service

up are the mountain pastures and rhododendrons, and above them come the snow-fields which cover one-twentieth of the whole area of the country. On the central plateau there is an average annual rainfall of 33 in., but in the higher regions the precipitation is much greater. The most remarkable prevailing wind is a hot, dry mountain wind called the *föhn*, which occurs most frequently in spring. The snowline lies at 7000 ft. to 10,000 ft.

The chamois and ibex are still found high up the mountains. The chief game birds are grouse, partridge, and snipe.

The discovery that tuberculosis could be cured in dry, cold, clear air, is one of the factors in the development of Switzerland as a health resort. Sanatoriums have been built at several points, and the hot springs and salt and mineral baths in Berra, Baden, and Schaffhausen attract numerous travellers. Magnificent scenery, a healthy climate, and unrivalled facilities for sports lure thousands of tourists annually to Switzerland, affording the republic one of its chief sources of income.



SCENES IN SWISS TOWNS

1. The Federal Palace (Parliament Buildings) overlooking the River Aare at Bern.
2. Old water tower and bridges at Lucerne.
3. General view of the lakeside at Lucerne.
4. Chalet at Saas-Fée.
5. "Bagpipes" fountain at Bern.
6. Rousseau Islet, Geneva.

Photos: Franz Schneider; Adilbodin; Reissmanns, Cortes: Swiss Federal Railways



SWISS FARMING SCENES

1. Cutting hay at 7000 feet. 2. Cheese-making outside a chalet. 3. Cattle on an "alp," upland pasture. 4. Sheep grazing 6000 feet above sea level in the Engadine.

Photos: F. Hütli, Pfeifer, J. Merkmeyer. Courtesy, Swiss Federal Railways

Agriculture. In spite of its mountains, glaciers, lakes, and rivers, over three-fourths of the area of Switzerland is productive. In addition to the forests, there are meadows and mountain pastures which support immense numbers of cattle and goats, reared for their milk, skins, and flesh. The dairy industry is important, especially on the plateau, and condensed milk and cheese are exported in great quantities.

In the valley of the Vorder-Rhein, rye is cultivated at the highest known elevation of cereals in Europe. But there are many communities which do not depend even upon rye, but gain their entire subsistence from the alps, or mountain pastures, where they feed their cattle during the short summer months.

In the lower valleys, rye, oats, and potatoes grow more successfully, and nuts, olives, and grapes are produced in favourable places along the lakes and on the southern slopes of the mountains; nevertheless, the great part of the food supplies of the country must be imported.

Though hampered by lack of coal and scarcity of iron, the Swiss have made remarkable progress in manufacturing. Cotton fabrics, machine-made laces and

embroideries are important products. Silk, ribbons and watches, jewellery and musical boxes find their way into the markets of all the world. Wood carving, straw plaiting and the manufacture of leather goods, woollen goods, confectionery and machinery are also important. The chief manufacturing cantons are Zurich, Glarus, Saint Gallen, Appenzell, Neuchâtel, Basel, and Genève.

Transport. Switzerland has three main trade routes—the Rhine Valley, leading to Belgian and Dutch ports on the north; the Rhône Valley, opening to France on the west, and a railway line southward through the St. Gotthard Tunnel. The Simplon, the longest railway tunnel in the world, pierces the Alps between Switzerland and Italy. There are 3218 miles of railway, much of which is electrified. About half of the railways are owned and operated by the state. There is also a network of roads which are kept in admirable condition.

Government. Switzerland is a confederation of twenty-two cantons, three of which, Basel, Appenzell, and Unterwalden, are politically divided into two half-cantons each. Four are called Forest Cantons, namely, Schwyz, Uri, Unterwalden, and Lucerne. They are grouped about Lake



THE CASTLE OF CHILLON ON THE LAKE OF NEVA

Lucerne. As Schwyz was the most prominent in the war for freedom, and members of the confederacy for independence were known to the outside world as Switzers, this canton ultimately gave its name to the entire league. Each canton has its own constitution and local government, and is divided for administrative purposes into districts. The districts are, in turn, divided into communes. In nearly all of the cantons, the principle of the initiative and the referendum is successfully applied. See REFERENDUM.

The executive power is vested in a Federal Council of seven members, elected for a term of three years by the Federal Legislature. The president of the Council, elected by the Federal Assembly for a term of one year, is also President of the Swiss Confederation during that time.

The Legislature is composed of two chambers, the National Council and the Council of States, the Swiss names for these bodies being *Nationalrat* and *Ständerat*. The Council of States is composed of two members from each canton, whose terms vary from one to four years. Each canton regulates the tenure of office, salary, and qualifications of its own representatives. The National Council is made up of members chosen for four-year terms by direct universal suffrage.

History. The country in Roman times was the home of the Helvetians and the Rhaetians, who at different times were conquered by Roman armies. During the German invasions, Switzerland was occupied by the Alemanni and the Burgundians, and eventually the whole country became a part of the empire of the Franks. In the eleventh century it came under the rule of the German emperors, and so became a part of the Holy Roman Empire. Late in the thirteenth century the House of Hapsburg, the imperial dynasty of Austria, became very powerful in the country. The tyranny of the Austrian rulers led to the formation, in 1291, of a league of three Forest Cantons—Uri, Schwyz, and Unterwalden—to resist Austrian oppression.

Typical of the spirit of the time, though perhaps not historically accurate, is the story of William Tell. In 1315 the first blow for liberty was struck when the confederation defeated the Austrians at the Battle of Morgarten. This victory gave the Swiss seventy years of peace.

Meantime Lucerne, Zurich (centre of a powerful coalition), Glarus, Zug, and Bern joined the confederation, and the united cantons were able to present a strong front against the Austrians when war was renewed. At Sempach (1386), where Arnold von Winkelried "made way for liberty and died," and at Näfels (1388), the Swiss were com-

pletely victorious, and Austrian power in Switzerland was permanently weakened.

In 1415 the cantons began offensive warfare, compelling Austria to relinquish Aargau, and about half a century later, they added Thurgau to their country. Then followed a war with Charles the Bold of Burgundy, in which the Swiss were again victorious. In 1481 the confederation was strengthened by the addition of the towns of Fribourg and Solothurn. Eighteen years later (1499), the Emperor Maximilian I began a war to place the Swiss again under the rule of the empire, but the cantons held their ground in six



MOUNT PILATUS FUNICULAR RAILWAY
Photo: F. Gortz, Court 'ry, Swiss Federal Railways

desperate battles. Though they were practically independent from this time on, their independence was not formally recognized until 1648, when the Peace of Westphalia was ratified. In 1501 Basel and Schaffhausen came into the confederation, and in 1513 Appenzell was admitted.

The Protestant Reformation, which began in Germany in this period, soon made itself felt in Switzerland, and the cantons were involved in religious wars in the sixteenth century. Through the influence of Zwingli and of Calvin, the latter of whom made Geneva his headquarters, Protestant doctrines spread rapidly through the country, difficulties between opposing factions were partially adjusted by the Peace of Westphalia, which closed the Thirty Years War.

Dissension between religious factions and a growing political aristocracy, with oppressive power in the hands of a few, marked the

next century-and-a-half in the loosely knit Swiss Confederation. The French Revolution affected many of the cantons, causing minor revolts against the aristocrats. When the French occupied the country in 1798, the short-lived Helvetic Republic was founded to take the place of the old confederation. In 1803 Napoleon organized a new confederation with nineteen cantons, and imposed a new Constitution.

When the affairs of troubled Europe were settled in 1814-1815 by the Congress of Vienna, the European Powers acknowledged the independence of Switzerland. After a Revolution in 1848, the old federation of states gave way to a federative state with strengthened central powers and efficient government. A further revision of the Constitution in 1874 gave more extensive powers to the central government.

During the World War, the country maintained its neutrality.

SWORD. A weapon of offence and defence, in general use since prehistoric days. The earliest forms of swords of which authentic information is available were those of the Assyrians, Gauls, and Greeks. The swords used by these peoples were made of bronze, and were short two-edged weapons. The Roman sword was of iron, short and straight, with a sharpened point and two cutting edges

With the invention of gunpowder, weapons designed for close combat declined in importance, but the light rapier remained the recognized duelling weapon. High art was exercised in the tempering of rapier blades, and Toledo became famous for the fine quality of its product. The favourite weapon of the East was the scimitar, a blade with a pronounced curve; Damascus was noted for its scimitar blades. The cavalry of modern armies bear swords of from 2½ ft. to 3 ft. in length and about 2½ lb. in weight.

SWORDFISH. A species of sea fish having a long, flattened upper jaw that resembles the weapon from which it derives its name. The swordfish is allied to the mackerels. The average length is 7 ft. and the weight is about 250 lb., but specimens weighing 600 or 800 lb. are recorded.

Scientific Name. The swordfish is *Xiphus gladius*.

SYCAMORE, sikh' a mor. A tree of the maple family, closely related to the plane, and in fact sometimes called the Mock Plane. A rapid grower, it flourishes even in poor soils, bearing large, dark-green divided leaves and the characteristic winged seed-vessels, or *samaras*.

Scientific Name. *Acer pseudo-platanus*.

SYDENHAM, CHARLES EDWARD POULETT, FIRST BARON (1799-1841). He was born at Waverley Abbey in Surrey. The son of a wealthy London merchant, he entered Parliament in 1826 where he strongly advocated a policy of Free Trade. He achieved Ministerial rank, and took important part in the passing of the Factories Acts of 1833 and in drafting the Bank Charter. His services were marked by the successful negotiation of commercial treaties. As Governor-General of Canada, he endeavoured to frame a workable constitution for the future of the Dominion, and his scheme led to the union of the provinces of Canada in 1867. See *Dominions and India* Volume.

SYDNEY. The oldest city and the chief naval station of Australia and, next to Melbourne, the most important British commercial centre in the southern hemisphere. It occupies a beautiful site on the southern shore of Port Jackson, about eight miles from the entrance to that vast harbour—now spanned by the largest free-arch bridge in the world—and has more than 23 miles of wharves and quays.

Sydney is an important manufacturing city, with numerous industries producing a wide variety of articles, and a clearing centre for perhaps half of Australia's trade. The city's suburban railway system is largely electrified. The total population of 1,256,230 embraces nearly half the people of the entire State. See **NEW SOUTH WALES**.



SWORDFISH

These were caught in the Bay of Islands, North Island, New Zealand.

Photo: High Commissioner for New Zealand

SYENITE, *si' en ile*. A name originally given to a hornblende granite, but now used for a coarsely crystalline rock composed chiefly of alkaline feldspars, together with hornblende and other ferromagnesian minerals. The augite syenite known as Laurvikite, found in Norway, is largely used as an ornamental stone for building purposes. The Charnwood syenite so largely used as roadstone in Leicestershire is now often known as Markfieldite, from the name of the chief quarries. See GRANITE.

SYLLOGISM, *sil' o jiz'm*. A term applied to a deductive process by which a conclusion is reached through the medium of two premises and a middle term. The standard form of the syllogism as elaborated by Aristotle is as follows—

All men are mortal,
Socrates is a man,
Therefore Socrates is mortal.

In this, "all men are mortal" is the major premise, "Socrates is a man," the minor premise; and "Socrates is mortal" is the conclusion. To Aristotle and the medieval "schoolmen" as well as to a number of modern logicians, the syllogism is the standard form of reasoning. It has been attacked on the ground that it is in fact a *petitio principii*, i.e., it is argued that the conclusion is contained in the major premise. The opponents of the syllogism urge that since "Socrates is a man," the truth that all men are mortal cannot be established until it has been established that Socrates is mortal. The major premise is a general statement which must of necessity contain all the particulars. The true method of reasoning, it is said, is by induction. By observing an infinite number of cases in which mortality has been associated with man without a single exception, we are justified in forming the conclusion that all men are mortal. But this judgment necessarily includes the so-called conclusion of the syllogism. See LOGIC.

SYLVINE, *sil' vin*. A colourless or white chloride of potassium, found associated with common salt and carnallite at Stassfurt.

SYMPATHETIC NERVES. Nerves originating in the spinal cord and connecting with bodily organs and muscles not under conscious control, such as the arterial and stomach muscles, and the pupil of the eye.

SYMPHONY, *sim' f3 ni*. A musical composition written for the orchestra. It consists usually of four movements, in form being the same as the sonata (which see). Haydn was the first great master to use the modern symphony form, but it was through the genius of Mozart and Beethoven that the symphony attained its present high rank.

SYNAGOGUE, *sin' a gog*. A place of local worship among the Jews. Supposed to have originated at the time of the Babylonian Captivity (sixth century B.C.), it was in existence, wherever the Jews had settled, at the time of Jesus, and continues among them to the present day.

In New Testament times, the synagogue was built at the cost of the community. It was so constructed that the worshipper, on entering or at prayer, faced in the direction of Jerusalem. The furniture included a chest, known as the Holy Ark, in which were kept the rolls of Scripture used in the service, a lamp that burned perpetually, symbolizing the presence of Jehovah; candlesticks for use on Sabbath and feast days; a rostrum for the reader, and probably a desk on which to rest the roll; seats for the elders, in front of the Ark and facing the people; and seats for the congregation, the men on one side and the women on the other, divided by a screen. The ruler of the synagogue was responsible for the service, and he chose those who should take part. The elders formed the lesser Sanhedrin, a body having civil and religious authority over local cases. They were examined by members of the great Sanhedrin, but were elected by the congregation.

SYNCLINE, *sin' kline*. The strata of the earth's crust usually lie in undulating folds. When the dip of beds is towards a central line, the strata are said to be in a trough or syncline, e.g. the London Basin is a syncline; the chalk of the North Downs dips under London to reappear in the Chilterns.

SYNCOPE, *sin' ko pe*. See FAINTING.

SYNCOPE, *sin' ko pe*. See FAINTING.

SYNCOPIATION, *sin' ko pi' shun*. Syncopation occurs in music when a beat that would normally not be accented is stressed. Syncopation is a common device in jazz music, though not peculiar to it. It has been made use of by Beethoven and other classical composers.

SYNCOPE, *sin' ko pe*. See FAINTING.

SYNDICALISM, *sin' dik al iz'm*. This word implies the idea that social revolution must come through the direct action of labour unions. It is a condition sought in the labour world, by which the day labourer shall control all industry. The exact means to be employed are difficult to state as, among those who call themselves syndicalists, there is some lack of unanimity of opinion. Syndicalists are not looking for success through the socialists, they do not hope for results through politics, although many of them belong to socialist organizations. They do not wish for ownership of industry by the State, unless they are strong enough to control its politics. They have learned to expect nothing from legislative action which will strengthen their cause.

They do not even look for support in their revolutionary plans from trade unionism collectively. They prefer a class warfare by which the workers are to free themselves by transferring the functions and the life of the State to their own unions. It is the hope of the syndicalists that the railway workers shall control all railways, that miners shall control all mines, that factory workers shall run the factories, and so on through the whole industrial range.

SYNDICATE. A combination of individuals or firms formed to promote some special purpose. The word is now more loosely used than was once the case, and many associations, from those of a few persons jointly holding or developing a property until it is in a fit condition to be sold to the general public through the formation of a public company, to those of big mergers, have been called syndicates.

SYNECDOCHE, *sin ek' do ke*. A figure of speech in which a part of a thing is used for the whole, or the whole for a part. It may be considered a form of metonymy. The expression "a fleet of forty sail" contains an example of synecdoche, *sail* being used for *ship*, or *ships*, or a part for a whole.

SYNGE, *sing*, JOHN MILLINGTON (1871-1909). An Irish dramatist, born at Rathfarnham, near Dublin. He studied at Trinity College.

After the completion of *Iran Islam* and the production of several short poems, he began, in 1903, to write plays, the prevailing note of which was sadness, whether they were comedies or tragedies. All the completed dramas deal with Irish peasant life, of which he gives fearless, melancholy, tragic, and humorous pictures.

His plays include *The Playboy of the Western World*, *The Shadow of the Glen*, *The Tinker's Wedding*, *Riders to the Sea*, and *The Well of the Saints*.

SYNOVIAL, *sin o' vi al*, **FLUID**. See **JOINTS**; **SECRETION**.

SYNTAX, *sin' takz*. A division of grammar that treats of the orderly arrangement of words to form sentences, and the grammatical relations of words in the sentence. *Syntax* is derived from a Greek word meaning "to put together in order," used to indicate the drawing up of an army in battle array.

The relation that any word bears to the other words in the sentence is known as its *syntax* or *construction*, and when an expression is used ungrammatically, such use is an error in syntax. See **GRAMMAR**; **LANGUAGE**.

SYNTHESIS, *sin' the sis*. Literally, the putting together of two or more elements, as in logic.

SYRACUSE, *si ra hús*. One of the most powerful cities of the ancient Greek world,

on the site of which a modern city has been built. Near the close of the eighth century B.C., a band of colonists from Corinth made a settlement on the small island of Ortygia, near the Sicilian shore. The colony developed into a rapidly growing city that soon spread over to the Sicilian mainland, which was connected with the islet by a causeway.

In the fourth century B.C., under the rule of Dionysius the Elder, it became a centre of Greek art and culture, and won renown because of a victorious war with Carthage. In 212 B.C. the city was captured by the Romans. Thereafter it gradually declined. Ortygia is now a peninsula.

Modern Syracuse, officially **SIRACUSA**, is the capital of a province of that name. Population, 50,320 (1931). Some Doric columns of antiquity may be seen in the cathedral, and there are remains of Roman temples, aqueducts, and an amphitheatre. The Great Harbour (Porto Maggiore) is still a busy centre of trade.

SYRIA. An independent state, under mandate of France from 1922. Formerly a part of Turkey, Syria extends from the Mediterranean Sea east to Iraq, and from Turkey on the north to Palestine and Trans-Jordan on the south. Since 1925 it has comprised four territories—Syria, Latakia (Latakia), Lebanon, and Jebel Druze. The total area is estimated at 60,000 sq. miles, and the population in 1929 was 2,831,600, of whom 1,696,638 were in the Syrian Republic, 286,920 in Latakia, 362,615 in Lebanon, and 51,780 in Jebel Druze.

Western Syria occupies a narrow strip of country between sea and desert. The land in general is divided into an eastern and a western tableland by a narrow rift valley over 400 miles in length. There are several mountain ranges along the coast, the loftiest being in Lebanon. The western part contains the middle reaches of the River Euphrates. The summers are long, hot, and dry; the winters are cold and snow is frequent.

The People and their Occupations. The people are mostly of Arab origin, and the principal foreign elements are Turks, Turks, Kurds, Circassians, Armenians, Persians, Jews, and a few Europeans. Arabic is the language in general use. The majority of the population are Mohammedans; there are about 500,000 Christians and 16,000 Jews. Education is provided through public elementary schools, secondary schools, and a few private institutions. There is a Syrian university at Damascus, and American and French universities at Beirut. See **DRUSES**.

The chief occupation is agriculture, though primitive methods prevail and only about one-fifth of the cultivable area is worked.



IN OLD PALMYRA

Part of a triumphal arch (*right*) and the columns of the Temple of the Sun. The capitals of the columns were stolen for the brass of which they were made

The principal products are wheat, barley, maize, olives, silk cocoons, and cotton. Cattle-breeding and sheep-raising are important. Other industries are almost negligible; some flour, oil, soap, silk thread, wine, and tobacco are produced.

In this land, where deserts and mountains abound, travel is difficult, but there is now railway communication with Smyrna and other Aegean seaports, with Palestine and Egypt, and with Iraq. Roads from Syrian ports lead via Damascus to Baghdad in Iraq, and this road is followed by the chief air route between Europe and the East.

History. Syria originally included the Holy Land, the birthplace of Christianity, and was the region in which the Israelites established themselves as a nation. Lying between two strong rival powers, it has played the part of a buffer, subject first to one great empire, then to another—Assyria, Babylonia, Persia, Macedonia under Alexander the Great, and Rome. In the seventh century A.D. it was conquered by the Arabs and in 1099 by the Crusaders, who in turn were driven out by the Egyptians in the twelfth century. In 1516 the Ottoman Turks conquered the country and remained in possession until the World War.

Two years before the World War began, Britain and France made secret agreements

regarding the partitioning of Syria and Palestine. In 1916 their intentions were made public in the Sykes-Picot agreement, by which Turkey in Asia was staked off into spheres of influence and assigned to the various Allies, France receiving Syria, and Britain being awarded Palestine. British and French troops entered the territory in 1918, but were not welcomed by the inhabitants, who had hoped to establish an independent state. In 1919, pleas for abandonment of the partitioning plans and the establishment of a free Syria were rebuffed. A short-lived constitutional monarchy, with Emir Feisal at the head, was set up in 1920, but he was driven out in August of that year, and French control was established. Turkey relinquished sovereignty over Syria by the Treaty of Sèvres, 10th August, 1920, but the treaty was never ratified. In 1922 the League of Nations sanctioned the French mandate over the area. Formal confirmation was made in the Treaty of Lausanne, 1923.

The Syrians continued to chafe under French rule, and in 1924 and 1925 several uprisings occurred. Finally, of the four territories, Lattaquié and Jebel Druze were administered by French governors. In 1930 the Syrian Republic was established with a constitution which provided for a president and a legislature. The Republic of Lebanon,



SYRIAN WOMEN WITH WATER JARS

though founded in 1920 and given a constitution at that time, was forced in May, 1932, to suspend the constitution until the local parties might become reconciled. In 1936 France announced the termination of the mandate in 1939.

The Cities. Damascus, the capital and largest city of Syria, is described in these volumes under its title.

Aleppo, or Halep, an ancient and important trade centre, lies 80 miles from the Mediterranean Sea. Except for intervals of disputed possession, it remained a part of Turkey until the World War. On the principal caravan route between Asia and Europe, Aleppo still has an important trade in manufactured articles. It is now a railway centre. The population is about 200,000.

Antioch, or Antakiya, was founded in 300 B.C. by Seleucus Nicator, who ruled over a part of the divided empire of Alexander the Great. As the capital of the Greek kings of Syria and later under Roman rule, the city famed for its luxury, was called "the Queen of the East." It is on the River Orontes.

Antioch was noted as one of the chief centres of early Christianity. After 538, when sacked by the Persians, the city never recovered its former splendour. At the present time, only the ruins of its walls and aqueducts remain. The site of the ancient city is occupied by the shabby town of Antakiya. The town has a population of 30,000 (1929).

Beirut, officially Beyrouth. The capital of Lebanon, and the chief seaport of Syria. Its chief exports are olive oil, cereals, sesame, tobacco, and wood; its manufactures are silk and cotton, and articles of gold and silver. In ancient times, Beirut was an important Phoenician city, but for centuries it passed from ruler to ruler until 1763, when the

Turks took possession. Population, 134,600 in 1929.

Palmyra was a celebrated city of antiquity, situated in an oasis in the Syrian Desert, about 150 miles north-east of Damascus. Its site is now occupied by a few Arab huts, but there still remain relics of former magnificence. According to tradition, Palmyra (the Tadmor of the Bible) was founded or enlarged by Solomon. As late as the fourteenth century it was a prosperous trading centre.

SYRIAC, sirriak. One of the two dialects of Aramaic (which see); most of the early manuscripts are versions of some part of the Bible. Down to the fourteenth century, the language had a vigorous life; later it declined, though, to this day, there remain in the Kurdish mountains and neighbouring districts tribes who speak a language called Syriac. This differs considerably from early Syriac. See ARAMAIC.

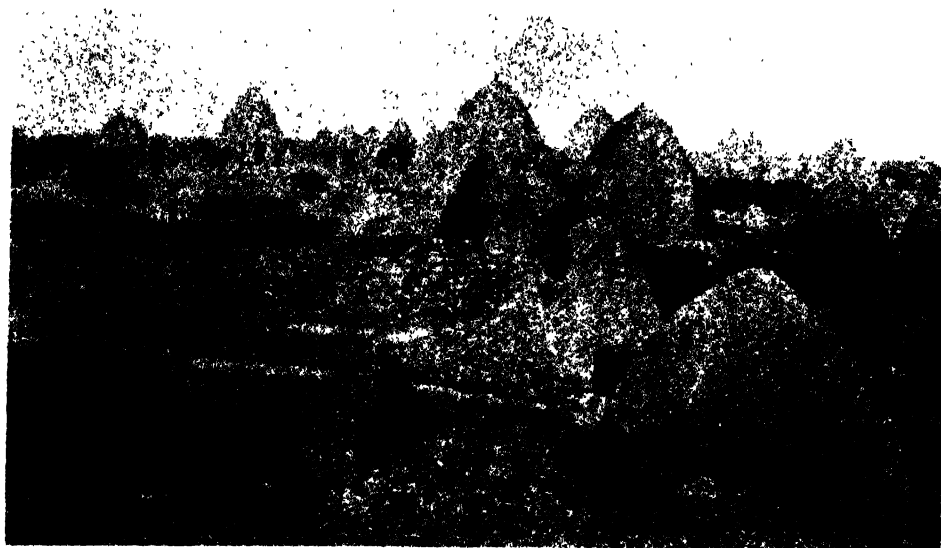
SYRINGA, sir ring' ga. The common name of a genus of flowering shrubs belonging to the saxifrage family (see SAXIFRAGE), of which the best-known species is the mock orange, or syringa, as it is also called. This plant is a hardy shrub that grows to a height of 10 ft. It is valued in landscape gardening because of its showy clusters of white, delightfully fragrant flowers.

Classification. The botanical name of the mock orange is *Philadelphus coronarius*. *Syringa* is also the generic name of the lilac (which see).

SYRUP. See MAPLE, SORGHUM, SUGAR
SZEGED, seg' ed. See HUNGARY



INTERIOR OF AN ARAB TENT
A primitive churn filled with goat's milk is in use
Photo L. & L.



SYRIAN HUTS
They are made of sun dried brick.
Photo OROC



PART OF THE CITY OF DAMASCUS
Photo: P. & A

THE WORLD BOOK

Tt

T. The twentieth letter in the English alphabet, derived from the twenty-second and last of the Phoenician alphabet. This was called the *tav*, or "*mark*"; it had practically the same value as the later Greek *tau* and the English *t*, and was made much like a capital *T*, except that the



vertical line extended through the crossbar. *T* is more closely related to *d* than to any other sound. In English, *t* has only one regular sound, but taken in connection with *i*, it is often pronounced like *sh*, providing another vowel follows the *i* in the same syllable, as in *partial*, *nation*, etc.

TAB ERNACLE. Centre of worship of the Israelites during their wanderings in the wilderness. Moses received instructions while on Mount Sinai for its erection (Exodus xxxiv, 30). The tabernacle was 45 ft. long, 15 ft. wide, and 15 ft. high. Its framework was of acacia boards, overlaid with fine gold. The interior was divided by the "veil," a curtain of linen, into the *Holy of Holies* and the *Holy Place*. The Holy of Holies contained the Ark of the Covenant, in which were kept the Tables of the Law, the pot of manna, and Aaron's rod. Above the Ark was the "mercy seat," a cover of solid gold, surmounted by two golden cherubim. In the Holy Place were the table of shewbread, the altar of incense, and the ten golden candlesticks.

The tabernacle stood within a court, 150 ft. long and 75 ft. wide, and was constructed so as to be easily moved from place to place. After the conquest of Canaan, the tabernacle was set up at Shiloh, and afterwards removed to Nob and then to Gibeon. From the latter place, it was brought to Jerusalem at the time of the dedication of Solomon's Temple.

In the Roman Catholic Church, the tabernacle is the receptacle in which the vessels holding the consecrated elements are kept.

TABLE TENNIS. Formerly known as ping-pong, this game was invented in England at the beginning of this century following the introduction of celluloid balls. It is an adaptation of tennis played on a table with small rackets usually covered with cork, sand-paper, rubber or vellum. The rules and

conduct of the game are governed by the Table Tennis Association.

TABOO, *ti boo'*, also spelt *Tavut*. A word of Polynesian derivation which has made



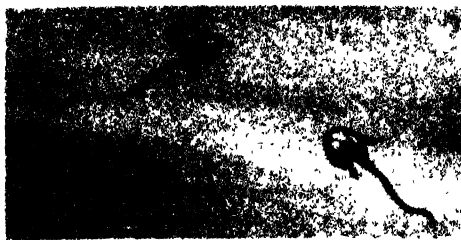
TABLE TENNIS DOUBLE

Photo Fox

its way into the current speech of civilized peoples, by whom it is employed with much the same meaning as *forbid* or *exclude*.

The practice of taboo among the Polynesians and various other primitive peoples consists in setting apart certain objects as unclean or sacred, or as having the power to injure. Such objects must not be touched, or, if words, they must not be uttered. This custom prevails among tribes in America, Africa, Central Asia, and India, and has a counterpart in certain religious practices of the Greeks, Romans and Jews.

TABRIZ, *tab reez'*. See PERSIA.



TADPOLES
Photo Weiler

TACHYLITE, *tak' il ite*. The glassy variety of basic igneous rock, such as basalt. Tachylites are black, but in the thinnest sections appear brown and partially transparent, owing to the presence of bits of magnetite. They are readily susceptible to weathering. Tachylite occurs as a thin crust on some lava flows but chiefly as a narrow selvage to basalt dikes. It is found in numerous places in the Tertiary volcanic districts of the Western Isles of Scotland, especially in the Isles of Skye, Mull, and Muck.

TACITUS, *tis' it us*, GAIUS CORNELIUS (about 55 about 120). A Roman historian. Of his life, nothing is known except what may be learned from his occasional references to himself, and from a series of letters written to him by his intimate friend, the younger Pliny. These sources tell us only that he held various public offices under Vespasian, Titus, Domitian, and Nerva, that he won a reputation as an orator and lawyer, and that he married the daughter of Gnaeus Julius Agricola.

Of the writings of Tacitus there remain the following: a discussion of eloquence, *Dialogue on Orators*, his first work, published early in life, the authenticity of which has often been doubted on internal evidence; the *Life of Agricola*, a biography of his father-in-law; the *Germania*, a description of the institutions and customs of the various German tribes; the *Histories*, of which there remain only the first four books and a part of the fifth, giving an account of the years 69-70; and the *Annals*, which originally consisted of sixteen books, giving the history of Rome and its provinces from the death of Augustus to that of Nero. Of these *Annals*, books seven to ten inclusive, with parts of others, are lost. Tacitus is our chief authority for the period of which he writes.

TACKLE. See PULLEY.

TACNA-ARICA, *ah re' ka*, **DISPUTE**. This arose over a region midway along the western coast of South America; practically a desert with few natural resources, it was under the sovereignty of Peru until captured by Chile in 1879. A treaty signed in 1883 allowed Chile to hold the area for ten years, but later

negotiations failed to reach a permanent settlement. The mediation of the United States in 1922 also proved ineffective.

In 1929, a final settlement was announced, by which Chile retained Arica and Peru took Tacna.

TADMOR (PALMYRA). See SYRIA.

TADPOLE. A term commonly applied to the larva of an amphibian (frog, toad, salamander, etc.), from the time it hatches from the egg until it takes on the characteristics of the mature animal. Properly, however, it is the name for the larva of a tailless amphibian (frog or toad), after it loses its external gills and before the forelimbs appear and the tail is absorbed. It lives in water. See FROG.

TADZHIK. See TAJIKISTAN.

TAEL, *tayl*. A coin of China.

TAFFETA, *taf' e ta*. A plain, lustrous, closely woven, rather stiff, but very smooth silk fabric. The name is derived from the Persian word *taftah*, meaning "spun, or woven." "Taffeta" was originally used as the name of all plain silks which were made simply by alternating the threads of the warp and the weft. See WEAVING.

The term Taffeta is a general name applied to fabrics of silk, rayon, worsted, cotton, and to a large variety of union cloths, in the plain weave.

TAFF VALE JUDGMENT. See CAMPBELL-BANNERMAN.

TAFT, WILLIAM HOWARD (1857-1930). An American jurist and statesman, the twenty-seventh President of the United States, and from 1921 to 1930, Chief Justice of the Supreme Court.

Taft's administration of 1909-1913 was markedly unpopular, although he is generally credited with the highest ideals.

The outstanding feature of the Presidency was its strong protectionist legislation. In relations with European countries, arbitration treaties were proposed with Great Britain and France but were not concluded. 1910 witnessed the end of a long-standing fisheries dispute with Great Britain.

TAGORE, *tah gor'*, SIR RABINDRANATH (born 1861). An Indian (Bengalese) poet, philosopher, and religious teacher, winner of the Nobel prize for literature in 1913. His



WILLIAM H. TAFT
Photo. U. S. U.

patriotic poems and songs helped to develop a racial and national consciousness, and won for him the name, "the Soul of Bengal."

In the beauties of Nature he sees God. All his creations contain much of that typical Hindu reverence which led his parents to send him, as a boy of eleven, into the Himalaya Mountains, that he might grasp the insignificance of the individual and the grandeur of solitude and space. Tagore is primarily the interpreter of the East. He has translated many of his works, including *Chitra*; *The Crescent Moon*; *The Gardener*; *Gitanjali* (*Song Offerings*); *King of the Dark Chamber*; *Post Office*; *Thought Relics*; and *The Wreck*.

TAGUS, tay'gus The chief river of Spain and Portugal; length 360 miles, of which only 50 are navigable

TAHITI, tah'he'le See PACIFIC ISLANDS

TAILOR BIRD. A song bird of India, Malaya, and the Philippines, so named from its habit of enclosing its nest within a large leaf, which it sews together at the edge with its slender bill.

Scientific Name. The tailor bird belongs to the warbler group. Its scientific name is *Sutoria sutoria*.

TAIL PLANE. Part of the tail unit of an aeroplane; it plays an important part in the control of stability. Since the nose of a machine tends to be somewhat heavier than the tail, the tail has a tendency to "lift." This tendency is counteracted by the pressure of the air which passes over the main planes and strikes the tail structure. So that the aeroplane may be "trimmed" in order that it may remain stable at different speeds and when differently loaded, the tail planes are adjustable so that the angle at which the air current meets them can be varied by the pilot.

TAINÉ, tayn, HIPPOLYTE ADOLPHE (1828-1893) A French historian and critic, born at Vouziers.

In December, 1863, his celebrated *History of English Literature* appeared, this has been translated into many languages, and it ranks as one of the greatest works of its kind. He continued to write critical studies on literature, art, and history, producing in the last fifteen years of his life his great work, *Origins of Contemporary France*, in which he discussed the causes of existing conditions in France. In 1878 he was made a member of the French Academy. Taine's whole life was marked by intense application; his writing is essentially logical and among the foremost examples in the analytic style.

TAIWAN. See FORMOSA

TADJIKISTAN OR TADZHIK SOVIET REPUBLIC. This was separated from the former regions of Bokhara and Turkistan and

constituted a republic in 1929. It has an area of 55,545 sq. miles, and a population of 1,332,700 (1933). It is mountainous, including part of the Pamir Plateau and ranges extending westward therefrom. There is much stock-raising and some cultivation of barley, wheat, fruit and cotton; gold and coal occur. Stalinabad (Dushambe) is the capital with a population of 60,000 (1935). It has rail connection with the Kazak republic, the Oxus valley, and with Europe.

TALBOT. See HOUND

TALBOT, FAMILY OF. See SHREWSBURY, EARLS OF.

TALC. A soft greyish magnesian mineral commonly found in flat, smooth layers or plates (foliated), but sometimes in compact form. This mineral is so soft that it can be scratched with the finger-nail. It is translucent, has a soapy feel, and is a poor conductor of heat. The foliated varieties may be white or greenish; the compact may be dark grey. Steatite and soapstone are massive varieties of talc. Talc is used in the manufacture of crayons, porcelain, furnace linings, heating stoves, electric insulation, toilet powders, such as *talcum*, and other commodities. French chalk is a fine granular variety serviceable for tracing lines on wood or cloth, etc.

Chemical Formula. The formula for talc is $H_2Mg_3Si_4O_{10}$, that is, a molecule contains two atoms of hydrogen, three of magnesium, four of silicon, and twelve of oxygen.

TALENT. An ancient coin and a unit of weight. The word occurs in the Greek of the New Testament, and it is in connection with ancient Greek standards that the measure is chiefly known. The Hebrews, however, also had such a weight, derived from Babylonia, and equal to 3000 shekels in silver.

The talent was the largest Greek unit, but it was by no means uniform in different Greek states and at different times. The one most commonly referred to is the later Attic or Solonic, which was equivalent to about 57 lb. A silver talent in Athens was worth about £250.

The Romans also made use of the talent, not as a coin but as a measure of money. They had a *great talent* and a *little talent*, the former worth about £120, the latter about £91.

TALKING PICTURES. See CINEMA.

TALLEYRAND-PÉRIGORD, tal'e rand' (in French, tah lè rahN pay re gor'), CHARLES MAURICE, DUC DE, Prince of Benevento (1754-1838). A famous French statesman. He was born in Paris. Owing to lameness, resulting from an accident in childhood, he was unable to embark on a military career, and was destined by his family for the Church, though he showed neither

inclination nor aptitude for religious life. In 1775 he was ordained. In 1780 he was made agent-general of the clergy of France, and in 1789 bishop of Autun. In that same year, he was elected deputy to the States-General for Autun.

On the outbreak of Revolution, Talleyrand was one of the committee appointed to draw up a Constitution, and by advocating the confiscation of Church lands won great popularity. Because he took the oath to the Constitution and acknowledged the supremacy of the State, he was excommunicated by the Pope in 1791. Meanwhile, he had been a founder of the Friends of the Constitution, afterwards the Jacobin Club, and had, in 1790, been elected president of the National Assembly. He was, however, not violent enough to please the radicals, and while in England on a diplomatic mission in 1792, he was forbidden to return to France.

By 1796, conditions had changed; Talleyrand was permitted to return to France, and secured the post of Minister of Foreign Affairs. He aided Napoleon in the moves by which the Directory was overthrown, becoming Grand Chamberlain in 1804, when the empire was founded. Talleyrand was the leading spirit in the formation of the Confederation of the Rhine, and in the negotiations with Prussia and Russia which, in 1807, culminated in the Peace of Tilsit. Soon after this, he resigned his office. He drew up the terms of Napoleon's abdication, and at the Congress of Vienna made use of his unusual diplomatic powers to obtain for France the status of a friendly power, not that of a defeated foe.

In later years, when Louis XVIII was established on the throne, Talleyrand took little part in public affairs, but when Louis Philippe became king by the Revolution of 1830, he succeeded in forming a quadruple alliance among France, Great Britain, Spain, and Portugal.

TALLINN (REVAL). See **ESTONIA**.

TALLOW. A hard, white substance obtained in the process of rendering animal fat, especially that of sheep, goats, and cattle. It is used extensively in the manufacture of soap, candles, and lubricants, and for dressing skins and leathers.

Tallow is a mixture of the solid fats palmitin and stearin, with the liquid fat olein.

TALLOW TREE. A Chinese tree (*Shi-lingia sebifera*) of the spurge family, whose seeds contain a wax which is used in candle-making. A tropical African tree (*Pentadesma butyracea*) is also known by this name as it yields a juice resembling tallow when the bark is cut; other trees of this kind yield the clear resin called *copal*, used in varnish-making.

TALMUD. Ostensibly the main book of Jewish civil and religious law, interpreting the Mosaic law, but better described as an encyclopaedia of Jewish social, economic, and religious life in the first five centuries of the Christian era. After the return of the Jews from Exile in Babylon in the fifth century B.C., Levitic teachers began to interpret the written Mosaic law with the aid of oral tradition. In the last years of the Second Temple, and in the centuries which followed, pious Jewish teachers began to collect these oral interpretations and to arrange them in a code. The first complete code, accepted as authoritative by the end of the second century A.D., was called the Mishna ("teaching"), and is the foundation of the Talmud. For during the succeeding centuries, the Jews used the Mishnaic laws as the basis for long, discursive discussions on all topics of Jewish interest, analysing the law with great subtlety, and adding anecdotes, sermons, etc. Similar discussions were conducted at Jewish academies in Palestine and Babylon. At the end of the fifth century, the Palestinian discussions (called the "Gemara") were collected by scholars and added to the Mishna to form the Palestinian Talmud. About a hundred years later, a similar process led to the editing of the Babylonian Talmud.

TAM'ARACK. A name applied to several American larches which are the chief feature of the "tamarack swamps" of the north-eastern U.S.A. The wood, which is hard and strong, is used for telegraph poles, fence posts, etc. The best-known species is *Larix laricina*. The name "tamarack" (derived from a native Indian word) is also applied to certain species of pine.

TAM'ARIND. A large tropical tree. Its fruit, a brown pod from 3 in. to 6 in. long, is filled with an acid, juicy pulp which is used in India to make cooling beverages, such as sherbet. This pulp, boiled in sugar or syrup, becomes the preserved tamarind of commerce. Tamarind seeds are used to make a yellow or red dye, and the root of the tree furnishes a beautiful hard wood.

Scientific Name. *Tamarindus indica*, in the family Leguminosae



TALLEYRAND

TAMBOURINE, *tam bū reen'*. An ancient musical instrument constructed on the principle of a drum, consisting of a circular



DANCER WITH TAMBOURINE
Photo: Topical

wooden or metal frame about 2 in. deep, across the top of which is stretched a piece of tightly drawn parchment. Little bells are attached to the hoop, and these jingle when the parchment is struck. The tambourine has no musical pitch, but is used merely to beat rhythm. The performer plays it by striking the parchment with the knuckles or elbow. Spanish and Italian peasants and gypsies use it for their dances, shaking it to make the bells jingle, or striking it while dancing.

TAMIL. See **LANGUAGES, PEOPLE** (Dominions and India Volume, India Section)

TAMMERFORS. See **FINLAND**

TAMPICO, *tam pe' ko*. See **MEXICO**

TANANARIVO, (*-re' vo*), OR **ANTANANARIVO**. The capital of Madagascar (which see)

TANCRED, *tan' kred* (about 1050-1112). Prince of Antioch. With his cousin Bohemund he joined the First Crusade, swore allegiance to Alexius, the Greek emperor, and took an active part in the siege of Antioch. In 1099 he carried out the capture of Bethlehem, was at the storming of Jerusalem, where he secured much booty and strengthened his power, being made Prince of Galilee. Between the years 1100 and 1103, during Bohemund's captivity, he served as regent of Antioch. Two years later, after the Battle of Harran, their first serious defeat at Moslem hands, Bohemund surrendered the government of Antioch to Tancred. In 1107 Tancred wrested Cilicia from the Greeks.

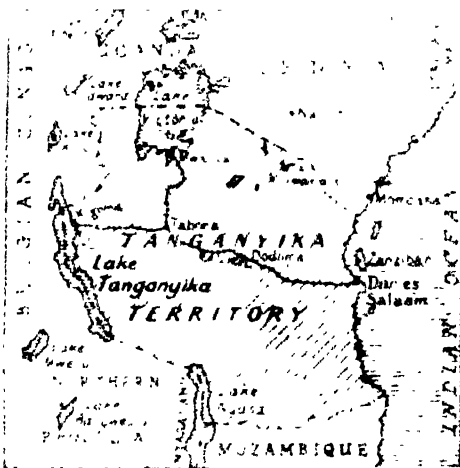
TANGANYIKA, *tan gahn ye' ka*. A large fresh-water lake, situated in the east-central part of Africa, 175 miles south-west of Victoria Nyanza. It lies in the east African rift valley and is about 450 miles in length but only 30 to 45 miles in width. Its area is about 12,700 sq. miles. The waters of Lake Tanganyika intermittently reach the River

Congo by way of the Lukuga, which flows from it on the west, and the lake is fed by several small streams. Its waters abound in fish, crocodiles, and hippopotami.

Tanganyika was first seen by Europeans in 1858, when the town of Ujiji, on its eastern shore, was visited by Burton and Speke. It was at this place, in 1871, that Livingstone was found by Stanley.

TANGANYIKA TERRITORY, from 1884 to 1919 known as **GERMAN EAST AFRICA**. Situated in the east-central part of the continent of Africa, it has an area of about 360,000 sq. miles with a native population of about 5,020,000, and about 8200 Europeans. The natives are mostly Bantus.

German East Africa was conquered, during the later years of the World War, by a combined British and Belgian force. The territory was placed under the control of Great Britain by mandate of the League of Nations, except about one-tenth of its area, which was annexed to the Belgian Congo. Its



affairs are administered by a governor, an executive council, and a legislative council, which was added in 1926. Slavery was abolished in 1923.

Resources and Chief Towns. The coast is low and flat, but most of the interior is a tableland situated at an altitude of 3000 to 4000 ft. South and east of this plateau are several chains of mountains. In the north-eastern corner of the colony rises the volcanic peak of Kilimanjaro (19,320 ft.) The rivers are not navigable.

Agriculture and cattle-raising form the chief occupation of the inhabitants. Millet, wheat, sisal hemp, cotton, tobacco, copra, rice, coffee, tea, and sugar cane are grown. Gold, mica, tin, and salt and, since 1926, diamonds have been mined.

The capital and chief seaport is Dar-es-Salaam (population 29,500); it is connected with Kigoma, on Lake Tanganyika (a distance of 774 miles) by the Central Railway which traverses the colony from east to west. Other railways total 508 miles. Plans have also been made to connect Tanga, the important seaport on the north, with Dar-es-Salaam.



IN TANGANYIKA TERRITORY

Above: Road through sandstone and shale near Beharamulo

Below: Harbour scene at Dar-es-Salaam

Photos: East African Dependencies Information Office

History. German colonization started here in 1884, and the boundaries of the colony were fixed by treaties concluded with Britain, Belgium, Portugal, and the sultan of Zanzibar between 1884 and 1890. A serious uprising of the natives that took place in 1905 was soon crushed, but it had the effect of making the German authorities improve their treatment of the natives. Since the World War, development under British Mandate has proceeded steadily.

TANGENT. In geometry, a straight line meeting the circumference of a circle and not intersecting it when produced.

TANGERINE, *tan jér ren'*. A variety of orange named after Tangier, Morocco. The tangerine is somewhat flattened, and is of a deeper colour than the common orange. The

peel is easily separated from the pulp, which is sweet and juicy.

Scientific Name. *Citrus nobilis*, var. *deliciosa*.

TANGIER, *tan jér'*. A town of Morocco, of which it is the principal seaport. There is a record which states that, in the year 788, Tangier was "the oldest and most beautiful city" of that part of the Continent. Though a part of Morocco, it is not under Moroccan jurisdiction, for the city and surrounding territory (see MOROCCO) have been internationalized since 1923. It is near the western entrance to the Strait of Gibraltar, about 35 miles south-west of the town of Gibraltar. There are few manufactures, but the city is the centre of the export trade of the country.

The total population is about 60,000 of which 16,000 are Europeans, 7,000 are native Jews, and 36,000 are Moors.

TANKS. Armoured fighting vehicles, carrying an armament of guns or machine guns with their crews and possessing a high capacity for cross-country movement, due to the replacement of wheels by motor-driven tractor bands.

Originally invented to destroy machine-gun nests and to crush the deep belts of defensive wire used in position warfare, changes in design in the direction of increased speed and radius of action at the expense of protection have revolutionized their mode of employment.

For close co-operation with infantry and for wire-crushing, the original forms have been replaced by slow-moving and heavily armoured "Infantry Tanks," and by those having a long-distance rôle as an armoured force of great speed and striking power.

In this rôle, the chief enemy of tanks is the anti-tank gun, a machine gun firing an explosive shell, which can penetrate the armour of a tank and burst among the gun crews. A tank force therefore needs great power of reconnaissance to locate these weapons and means of close support to blind or destroy them. Tanks are therefore organized into *light*—or "whippet"—tanks, *close support* tanks and *medium* tanks.

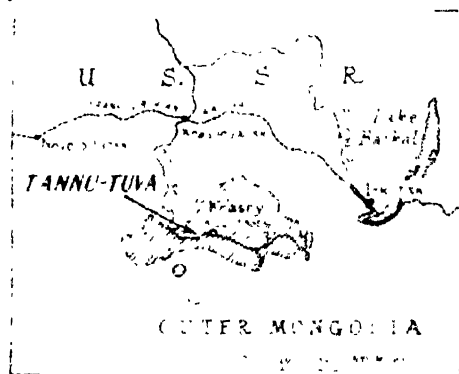
TANNENBERG, BATTLE OF. See HINDENBURG; WORLD WAR.

TANNIN, OR TANNIC ACID. In a specific sense, these names are applied to an acid found in large quantities in gallnuts, produced on plants by the larvae of insects (see GALLS). It is a compound of carbon, hydrogen and oxygen, and is an almost colourless,

odourless powder, soluble in water and alcohol, and having a bitter taste. The term is also applied to a group of vegetable compounds widely distributed in plants, especially oak, acacia, quebracho, eucalyptus, hemlock, sumac, valonia, man-grove, and chestnut. The tannin in tea is extracted by boiling, and is recognizable by a bitter flavour. Tannins of commercial importance find wide use in the tanning industry, as mordants in calico-printing and dyeing, in ink manufacture, and as astringents.

TANNING. See LEATHER, TANNIN, above.
TANNU-TUVA OR TUVINIAN REPUBLIC.

This lies in the north-west of Mongolia and is a semi-independent state under Soviet protection. Known as the Uryankhai, it was



part of Mongolia until the Mongolian rebellion of 1911. In 1914 Russia proclaimed a protectorate, but in 1917 the area revolted to China. In 1926 a treaty of friendship was signed between Outer Mongolia and Tannu-Tuva. The area is 64,000 sq. miles and the population is about 65,000, of whom the majority are Tuvonians, a Turki people. There are about 12,000 Russians. Occupations are pastoral and hides and wool are exported. The capital is Krasny (Kizyl-khoto) with a population of 10,000.

TANSY. A herb of the composite family, whose leaves and flowers have a bitter taste and a powerful aromatic odour. Oil of tansy, yielded by the leaves, is poisonous, but is used in medicines to a limited extent. The plant grows commonly along roadsides. It bears dark-green, feathery leaves, and flat-topped, yellow flowers, which appear at the top of the stem. The tansy is a native of Europe.

Scientific Name. Tansy belongs to the family *Compositae*. Its botanical name is *Tanacetum vulgare*.

TANTALUS. In mythology, a Grecian king, the son of Zeus and the father of Pelops. According to the legend, he killed

his son Pelops and served him as a dish to the gods, who in punishment condemned Tantalus to terrible, eternal sufferings. Plagued by an unquenchable thirst, he was made to stand immersed to the chin in water, which always receded when he tried to drink; gnawed by never-ceasing hunger, he saw, hanging above him, fruit-laden branches which always swung away when he tried to reach them. From this legend the word *tantalize* is derived.

TAOISM. *lou' iz'm.* A philosophical doctrine preached in China in the sixth century B.C., by Lao-tse, a contemporary of Confucius. At the present time Taoism holds an important place among the Chinese religions. The priests of Taoism claim to have magic powers, and the ritual is a combination of witchcraft and demonology. Simplicity and frugality are necessary virtues in Lao-tse's system. He held that one should have the ability to find contentment, regardless of poverty and privations.

TAPESTRY. An ornamental fabric used for decorating the walls of churches and palaces, and as a covering for windows, archways, furniture, and floors. Tapestries are made by a special process of weaving, described by an American authority on the subject (Charles M. Froulke) as follows—

"Tapestries are made by interweaving variously coloured wool (i.e. weft) threads with undyed warp threads, after the warp threads have been stretched upon a loom, either vertically or horizontally. This interweaving is done with an implement called in French a *broché*, which is neither a shuttle nor a bobbin, but partakes of the character of both, and for which there is no equivalent word in English. The picture represented is developed upon the warp by the different colours of the wool threads. Needles are never used in weaving tapestries. In the process of weaving, the wool becomes practically an integral portion of the completed structure."

Tapestry-making, which dates from antiquity, reached its artistic heights in the fifteenth century. The industry was then centred in Flanders at Arras (now a city of France), and so excellent were the tapestries made there that the name of the city was applied to the fabric itself. Antwerp, Brussels, Bruges, Lille, and Valenciennes also developed as important centres of tapestry-making, and the art was placed under royal protection in both France and Flanders.

In Paris, early in the seventeenth century, a factory under royal patronage was established in the dye works of the Gobelin family, and in 1662 the property was transferred to the control of the state. Gobelin tapestries became world famous, and the



TAPESTRY

1. English (Mortlake) tapestry woven in coloured wools and silks and silver gilt and silver thread. The subject is the gods' discovery of the amours of Mars and Venus, and it forms one of a series of nine representing the History of Vulcan. It was probably produced in the reign of Charles I in honour of the Prince of Wales, afterwards Charles II. 2. German, made in the second half of the fifteenth century, woven in coloured worsteds on flax warps. The subject is the field labours of the various months. 3. Woven in coloured wools and silks and designed by William Morris with a subject taken from his poem "The Orchard," the flowering plants are by H. Dearle, Director of the works at Merton Abbey where the tapestry was woven. 4. Section of Brussels tapestry made about 1520-30 showing the Courts of Love, Religion, and War. 5. Flemish tapestry.

Photos: Victoria and Albert Museum



TAPIOCA PLANT

Photo Australian Trade Publicity

present museum connected with the establishment is one of two in existence in which tapestries and textile fabrics alone are exhibited. The other is at Florence.

Bayeux, bay'æ'. Tapestry, the most remarkable and costly embroidery remaining from early medieval times, picturing, in a series of scenes, the life of Harold and the invasion and conquest of England by William the Conqueror. Tradition asserts that it is the work of the latter's wife, Matilda, and that it was made for Odo, bishop of Bayeux, as a decorative hanging for his cathedral, where it was found. It is 230 ft. long and about 20 in. high, and contains 1512 figures and inscriptions in Latin, worked in red, green, blue, and yellow wool, on a white canvas foundation. Authorities do not hesitate to consult it for details as to the manners and costumes of the time which it represents. The tapestry is still kept in the library in the town of Bayeux in Normandy.

TAPEWORM. An animal parasite that lives in the intestines of human beings and certain lower animals. It has a very small head and many body segments, and may vary in length from a few inches to ten yards. The parasite grows by the formation of new segments, or buds, which develop behind the head and are continually pushed backward as others form. The head has a ring of four sucking discs, by means of which the animal attaches itself to the mucous membrane of the intestine. It obtains food by absorbing nourishment through its skin; the body floats freely, and can take in nutriment from all sides. There are no digestive organs, and there is no mouth.

Fertilization of eggs occurs in each division of the worm, and when the embryos reach a certain period of development, some of the end sections separate from the others and pass out of the victim's body.

There may be no symptoms of tapeworm. The presence of a tapeworm being established, treatment is carried out by drugs called *anthelmintics*. The best of these for tapeworm is the extract of male fern. Tapeworms enter the body through the eating of poorly cooked pork or beef, or of fish infested with the larvae. See PARASITIC DISEASES.

TAPIO'CA. A food starch widely used in the preparation of puddings. It is obtained from the root of cassava, a tropical plant (see CASSAVA). There are two forms of root, the sweet and the bitter. The tapioca of commerce is extracted from bitter cassava, and comes chiefly from Brazil and the Straits Settlements.

TAPIR, tay'per. An animal related to the horse and the rhinoceros. There are five living species, four being found in the western hemisphere. The chief characteristics of the tapirs are a clumsily built body,



SADDLE-BACKED TAPIR

Photo Wide World



BRAZILIAN TAPIR

Photo Wide World

short, stout legs, thick neck, and nose prolonged to form a movable trunk, or proboscis. They belong to the odd-toed mammals (see UNGULATES); the front feet have four toes and the back ones three. Tapirs are solitary, amiable creatures, that live in the depths of the forests and frequent regions near water. They feed on shoots of trees, fruit, and other vegetable food.

There are two species in South America, the most common of which inhabits the forest regions east of the Andes, the other dwells high up the slopes of these mountains. In Central America there are two species of hog-like tapirs, the smallest of the family. The Old World species is found in the Malayan region. It is nearly 4 ft. in height, and its back, rump, and sides are white, and the rest of the body a glossy black.

Scientific Names. Tapirs belong to the family *Tapiridae*. The species found east of the Andes is *Tapirus terrestris* (or *americanus*). The tapir of the Andean slopes is *T. roulei*. The Central American species form the sub-genus *Tapirella*. The Malayan is *Tapirus indicus*.

TAR. When used without any qualifying word, this term refers to *wood tar*, the product of the special distillation of several kinds of wood, including pine, fir, and larch. *Coal tar* (which see) is a by-product obtained from bituminous coal.

Wood tar is a dark-coloured, semi fluid substance with a strong, pungent odour. It is used for coating and preserving timber exposed to the weather, for caulking seams in boats, and in the construction of roofs. Medically, it is valued for its antiseptic qualities, and is used in the preparation of ointments and lotions for treating skin diseases. The usual method of producing tar is by distillation in retorts or ovens. Among its by-products is wood pitch, which is employed in the manufacture of varnish. Another by-product is creosote (which see).

TARANTEL'LA. An Italian folk dance.

TARANTO, *tā' ran tō.* See ITALY.

TARANTULA, *tā ran' tū la.* A large spider named after Taranto, a city of southern Italy, where it was first closely observed. The name is now commonly used to denote any of the large venomous hairy spiders, particularly in Central and South America, where they are abundant. Tarantulas catch their prey, not in a web, as do most spiders, but by tracking it down. Their bite is painful, but not fatal.

Scientific Names. The tarantula of Italy is named *Lycosa tarantula*, of the family *Lycosidae*. The American spiders of that name belong to the family *Theraphosidae*.

TARBUSH, *tar boosh'.* See FEZ.

TARE. A name applied to various species of vetch, but most often to *common* or

spring vetch. The plant mentioned in the parable of the tares and wheat (see Matthew xiii. 24-30), was probably darnel. See VETCH.

TARGUM, *tar' gum.* A translation of the Old Testament into Aramaic. From about 400 B.C., the language of Jews in Palestine was Aramaic, and in the Synagogues the scriptural readings were regularly translated from the original Hebrew into this language.



TARANTULA SPIDER

On the basis of these popular paraphrases but centuries after the practice began, Aramaic translations were made, at different times, of the various books of the Bible and called Targums ("translations"). There are extant three Targums on the Pentateuch, and one on most of the other books.

TARIFF. A list or schedule of duties levied on goods sent to or arriving from foreign lands. In its original meaning, a tariff was not a tax or duty, but rather a list of articles on which duties were levied. The word is derived from the Arabic *tarif*, meaning "giving information or giving notice."

Tariffs are levied for three purposes: (a)

as a means of obtaining revenue for a country; (b) as a means of keeping out certain foreign goods while a nation is developing its own capacity to manufacture these goods; and (c) as a means of retaliating upon other nations for imposing high rates. Practically all countries levy a duty on most of their imports, especially upon manufactured goods. Since the war, tariff developments have included attempts to draw up lists that hold the balance between consumers and producers. It is generally agreed that a tariff can "protect" any given industry from foreign competition, but it may also, if prohibitive, lead to industrial exporting inefficiency.

British Tariff System. Before 1932 this consisted (a) mainly of revenue duties, levied under various Finance Acts upon tea, coffee, cocoa, hops, beer, silk, etc.; (b) the so-called McKenna duties, which were first introduced during the war; and (c) duties brought in under the Safeguarding of Industries Act in 1921, which were to have existed for a period of five years, but have since been extended.

Following the economic upheaval of 1931, Parliament passed and brought into force on 1st March, 1932, a comprehensive Import Duties Act, which introduced a general *ad valorem* duty of 10 per cent on all goods (other than those mentioned in a short free list) coming into the country and not already dutiable under other Acts. The "free list," which has since been slightly amended, included bullion, wheat, meat, tea, raw cotton, flax, wool, skins, newsprint, wood pulp, rubber, coal, and a large number of other raw materials.

The most important clauses of the Act were, however, those that established an Import Duties Advisory Committee, consisting of a chairman and not less than two other members, to make recommendations to the Treasury on all matters connected with tariffs, so that industrialists and traders who desire to have an imported commodity placed on the tariff list, or desire an amendment to an existing tariff, have the right to make an application to the Committee. If the applicant has established a *prima facie* case, notice of the application is at once published, with an invitation to all interested parties to make whatever representations they think fit.

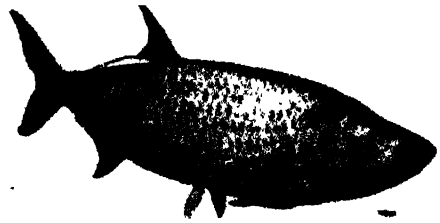
The committee very early decided to put a tariff of 15 per cent on semi-manufactured goods, of 20 per cent on most fully-manufactured goods, and of 25 to 30 per cent on luxury or semi-luxury goods. Following the Ottawa Conference of 1932, a new schedule of duties was added to the British tariffs which included specific or *ad valorem* duties

on foreign wheat, maize, butter and various dairy produce.

Other Tariff Systems. Under an Act of 1922, the United States Tariff Commission was empowered to investigate the cost of production in the United States of any given commodity, as well as to ascertain the production costs of similar goods in foreign countries, so as to recommend to the President a rate of duty that would equalize competition between home and foreign producers. Foreign producers, if they believed that an American tariff was unfair, were allowed to state their case before the Tariff Commissioner.

Australia, Canada and India have also embodied the same principle in their tariff relationship with Great Britain.

TARPON. Abundant in Mexican and Floridan waters, the tarpon is a member of the herring family. It is one of the gamest



TARPON
Photo. Herridge

of sea-fishes and is renowned for its spectacular leaping when hooked by the angler. It has little or no commercial value, though the large tough scales are sometimes used for ornamental purposes. The fish may grow to a length of 8 ft. and a weight of over 200 lb.

Scientific Name. *Tarpon atlanticus*

TARQUINIUS, *tar kwīn' ius*, LUCIUS, surnamed PRISCUS. The fifth legendary king of Rome, who reigned from 616 to 578 B.C. Although not of the royal house, he became guardian of the sons of Ancus Martius on the death of that king, and gradually attained the royal power. He waged successful war against the Sabines and the Latin cities, made vassals of the powerful Etruscan cities (see ETRURIA), and began many great public works, among which were the *cloacae*, or sewers, the Circus Maximus, and the Temple of Jupiter on the Capitoline Hill. He was assassinated by the sons of Ancus Martius.

TARQUINIUS, LUCIUS, surnamed SUPERBUS (THE PROUD). The last of the legendary

kings of Rome, whose reign was from 534 to 510 B.C. He was the son of Tarquinius Priscus and the son-in-law of Servius Tullius, whom he had put to death to secure his own accession. His reactionary policy induced unpopularity, and the crime of his son, Sextus Tarquinius, against Lucretia precipitated a rising which drove Tarquinius from the throne and resulted in the founding of the Roman Republic. See LUCRETIA.

TARSUS. The most important town of ancient Cilicia, Asia Minor, and noted as the birthplace of the Apostle Paul. In the days of Paul, it was one of the "free cities" of the Roman Empire, and was renowned as a centre of education and culture.

TARTAN. The name of a worsted cloth chequered or crossbarred with threads of different colours (derived from the French *tartane* and the Spanish *tartaña*, meaning a thin woollen or silken cloth). The Scottish Highlanders have for centuries made use of tartan materials for their kilts and plaids, as the gay, variegated patterns blend with the diverse, perpetually shifting colours of the Highland scene and make the wearer hard to pick out at any distance. Each clan claims its own distinguishing tartan. Highland dress was banned after the Jacobite venture of 1745 but again allowed in 1782.

TARTAR, OR ARGOL. A substance deposited as a hard crust on the sides of casks during the fermentation of grape juice. Chemically, it is impure acid potassium tartrate. It is important commercially as the source of cream of tartar.

TARTARIC ACID. A vegetable acid whose potassium salt is found in many plants and unripe fruits, but especially in grapes. It is obtained commercially by treating the tartar deposited in wine casks (see above) with lime and sulphuric acid.

Chemical Formula. The formula for tartaric acid is $C_4H_4O_6$; that is, a molecule contains four atoms of carbon, six of hydrogen, and six of oxygen.

TARTARS, OR TATARS. Originally the name applied to the peoples of Central Asia who lived in North-eastern Gobi in the fifth century, and, driven southward by the Turks four hundred years later, founded the Mongol empire. To-day, the term is used to designate many peoples, principally of Turkish origin, living in Western Asia and European Russia. See RACES OF MAN.

The western invasion of the Mongols in the thirteenth century gathered many Turki peoples as it approached the Ural and Altai mountains and the plains of Eastern Russia. There are innumerable groups living in European Russia and Siberia which are given the name Tatars, or Tartars, though their characteristics and original stocks vary

with their geographic situation. The main group is now organized into the Tatar Autonomous Republic, with its capital at Kazan. See RUSSIA.

Tatar (pron. *tah' tar*) is a Tungus or Manchurian word, meaning "archer or nomad." It took the form *Tartar* at an early date by association with *Tartarus*, the Hades of classic mythology (see below)



TARTAR CHIEF FIRMING A PISTOL
From a painting by Hokusai
Photo: British Museum

TARTARUS, tar' tar' us In early Greek mythology, an abyss surrounded by the River Phlegethon, where Zeus imprisoned the rebellious Titans (which see). Later the name was used interchangeably with Hades, although Homer places it as far below Hades as earth is below heaven.

TASHKENT. See UZBEK.

TASMANIA, taz may' nia. Formerly called VAN DIEMEN'S LAND, a state in the Commonwealth of Australia. It consists of one large and several small islands, separated from the south-eastern part of the mainland by Bass Strait, 140 miles wide. The area of the entire state is 26,215 sq miles, and the population is 229,711 (1935). The aborigines of Tasmania are extinct. Elementary education is free and compulsory between the ages of 7 and 14.

Physical Features. The coast is remarkable for its bold headlands and picturesque inlets. The interior of the island forms a plateau with an elevation of between 3000 and 5000 ft. above the sea level; this plateau contains many lakes. The mountains bordering the central plateau do not reach a very great altitude, the highest point being Mount Cradle, which is 5069 ft. above sea level.

The geological formation of Tasmania is



KING RIVER, TASMANIA
Photo Australian Trade Publicity

intimately connected with that of Victoria, in Australia, to which it was joined until after the Miocene Period.

The plant life resembles that of the continent as a whole, as also does the animal life, except for the absence of the dingo, or wild dog of Australia. The Tasmanian wolf and the untamable "Tasmanian devil," resembling a small bear, are peculiar to the island.

The climate is cool-temperate. The heat is not usually excessive, though, during exceptionally hot periods, the thermometer has been known to rise as high as 100° F., it seldom drops below 47° F. The rainfall at Hobart is about 24 in., spread throughout the year.

Industries and Transport. The soil is fertile, and agriculture forms the chief occupation of the inhabitants. Oats and wheat are the chief grains. Hops, peas, hay,

and potatoes are also grown. Fruit, especially apples, is extensively cultivated. The pastoral lands support great numbers of sheep and cattle, but the "meat" cattle are being supplanted by dairy herds. The forests yield great logs of eucalyptus. Mining includes copper, gold, silver, tin, lead, zinc, shale, and coal.

The principal industries are mining, the operation of metallurgical plants, saw-milling, the production of jams and preserves, dairy products, bricks, tiles, and pottery, and tanning. Smaller, but rapidly becoming more important, are the chemical, carbide, and electrode industries, especially those connected with zinc; furniture manufacture, and the making of farm implements. Much water power is used.

The total length of the railways is about 800 miles. More than three-fourths of the mileage is owned by the State.

Government and History. The government of Tasmania is similar to that of each of the other Australian states. The chief executive is a Governor, and there is a Legislative Council of eighteen members, chosen for six years, and a House of Assembly, whose thirty members are chosen for three years.

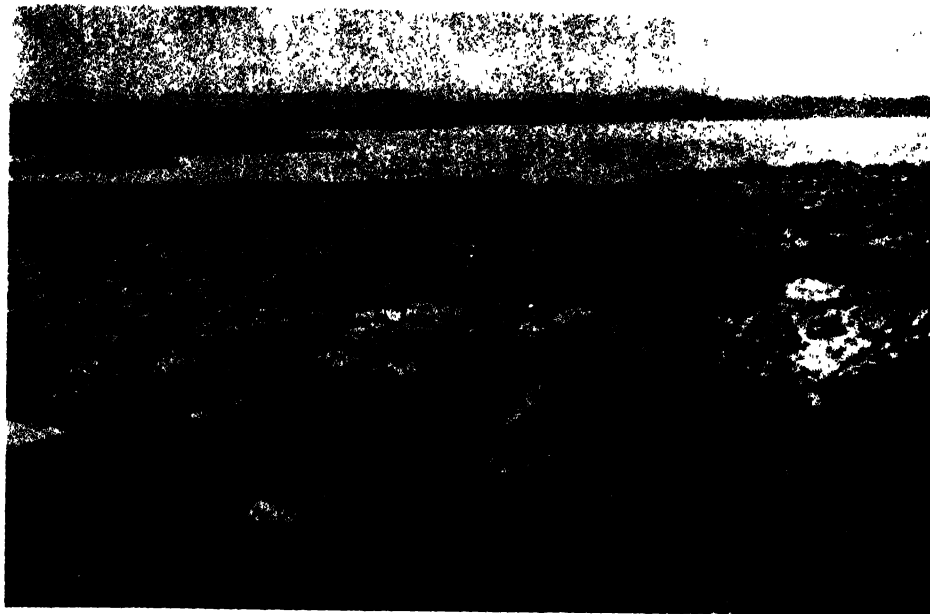
Tasmania sends six Senators and five Representatives to the Federal Parliament of Australia.

Van Diemen's Land, as Tasmania was first named, was discovered by Tasman, the Dutch navigator, in 1642. It was settled in 1803 by a party of convicts from Great Britain, and for fifty years received convicts from all parts of the British Isles. When the convict-settlement system was abolished in New South Wales in 1840, demands for similar reforms and a responsible government arose in Van Diemen's Land. In 1853 this was partly accomplished, and the name of the island state was changed to Tasmania; however, responsible government did not come until three years later.

Hobart, prior to 1881 called HOBART TOWN, is the capital of Tasmania. The city lies on a bay of the Derwent River, 12 miles from its mouth; the harbour accommodates the largest vessels. Situated in the midst of the fruit-growing district of Tasmania, Hobart has a large export trade in fruit, as well as in timber, flour, etc. It is the seat of the state university. Population, including suburbs, 61,740 (1935).

Launceston (population 32,700), on an inlet in the north, is the second town. It is a port with extensive docks, and has considerable coasting trade with Australia.

See AUSTRALIA (Dominions Volume) for separate articles on Physical Features, Education, Government, Transport, etc.



HOBART HARBOUR, TASMANIA
Photo: Australian Trade Publicity



ANOTHER VIEW OF HOBART HARBOUR
Mount Wellington is in the background.
Photo: Australian Trade Publicity

TASMANIAN DEVIL. A carnivorous animal peculiar to Tasmania and noted for its ferocity. It is a burrowing marsupial, with coarse black hair. Though only about



TASMANIAN DEVIL
Photo Australian Trade Publicity

the size of the common badger, it sometimes destroys sheep. Its scientific name is *Sarcophilus ursinus*, showing its relationship to the bear family.

TASMANIAN WOLF, also called ZEBRA WOLF. A pouched animal that resembles a wolf or wild dog in appearance. It is a native of Tasmania and is usually about 40 in long or larger. The short fur is greyish-brown, and there are black stripes across the back, much like those of a zebra. The nose is long and sharp, and the tail is tapering. The animal differs from others of the family in that the marsupium, or brood pouch, opens backward. See MARSUPIALS.

Scientific Name. The Tasmanian wolf belongs to the marsupial family *Dasyuridae*. Its scientific name is *Thylacinus cynocephalus*.

TASSO, TORQUATO (1544-1595). Italian poet and dramatist; born at Sorrento, educated in Rome. He was sent, at the age of 16,



TASSO
Photo: Brown Bros.

to the University of Padua to study law, but within a year produced a romantic poem in twelve cantos, entitled *Rinaldo*. This remarkable work, dealing with the legends of Charlemagne, was well received.

His great admiration for Virgil, allied with popular clamour for a crusade against the Turkish invaders, suggested respectively the

style and theme of his *Jerusalem Delivered*, which was based upon the adventures of

Godfrey de Bouillon in his crusade to Jerusalem. A quarrel with his patron, Cardinal d'Este, sent him forth penniless in 1571, but Duke Alfonso of Ferrara sheltered him, and, under the patronage of this nobleman, he produced in 1573 the *Aminia*, possibly the most beautiful of all Italian pastoral plays.

In 1576 he showed signs of insanity, consequent on physical injury and on a charge of heresy brought against his work. He was taken to a country home, but escaped and wandered from town to town. In February, 1579, he returned to the court of Ferrara, and burst into the ducal rooms with such signs of rage that he was confined as a madman. At length he was allowed to go to Naples, where he composed his *Jerusalem Conquered*, really a revision of the other epic.

In 1594 Tasso was invited to Rome by Pope Clement VIII to be crowned for his poetry, but in the midst of the preparations, he became ill; within a few months he died in the Convent of Santo Onofrio, near the city. The pathetic story of his life has furnished a theme to such writers as Goethe, Lamartine, and Byron. *Rinaldo*, the *Aminia*, a tragedy entitled *Torrismondo*, and *Jerusalem Delivered* are among the greatest of Italian writings.

TASTE. When we speak of the "taste" of a substance we usually refer to a complex of sensations aroused by stimulation of sense organs in the mouth and nose. Our actual taste sensations are strictly limited. They are of four kinds. sweet, salt, sour and bitter. They are aroused by stimulation of *taste-buds*, minute sense-organs situated mostly in the tongue, although some taste-buds are to be found in other parts of the mouth and throat. They are more widely distributed in children than in grown-ups. If our true tastes are so limited, how is it then that we can distinguish so many different substances and different flavours? The answer is, through the co-operation of other senses. When we take a substance into our mouths we receive not only taste sensations but sensations of heat and cold, tactile sensations dependent upon its texture, and kinaesthetic sensations derived from the movements made with tongue and jaws. In addition—and very important—the sense-organs for smell, situated in the back of the nose, are stimulated by the aroma which reaches them from the mouth. This gives us much of our power of discriminating flavour. For example, a person who has a very bad cold, which prevents currents of air passing from the mouth through the nose, will find his food very insipid, although a sour or bitter taste, or the tactile sensations from an oily substance, will not be affected.

We see then that what we usually understand as "taste" is really a complicated affair in which pure taste sensations are combined with others, especially touch, temperature and smell sensations. See SENSATION; SMELL.

TATTOOING. The art of making permanent scars in patterns on the skin. It originated as a purely decorative custom, but among some races it grew to have a religious or tribal significance. Needles of steel, bone, or shell are used to puncture the designs in groups of lines and dots, and one or several colours is employed to set the patterns permanently. Dark-skinned races practise a related art, *scarification*, or gashing the skin and rubbing in ashes, charcoal, or clay, which causes light, raised scars. Another method, *branding*, consists in inserting splinters of wood in the skin and setting them afire.

TAUNTON. Municipal Borough and County Town of Somerset, on the River Tone, 163 miles from London. Noted chiefly for the produce of its cider presses, it also manufactures collars and agricultural implements. The lofty tower of the church of St Mary Magdalene is a replica of the fifteenth-century fabric. The Castle is now a museum. Taunton was Judge Jeffreys' centre of operations in the "Bloody Assize."

TAURUS, tau'rus, THE BULL. The second sign of the zodiac, into which the sun enters about 20th April. The symbol of this sign is ♉. The constellation Taurus contains, altogether, about 140 stars visible to the naked eye, in the northern hemisphere, it is overhead in December and January. The clearest star is Aldebaran, a red star of the first magnitude. The V-shaped cluster of Hyades forms the face of the Bull, and the Pleiades are also in this constellation. See PLEIADES.

TAURUS MOUNTAINS. See TURKEY.

TAXATION AND TAXES. A tax is a compulsory contribution from a person or body of persons to the government, exacted to defray the cost of services performed for the common benefit, without reference to individual benefit.

Many inscriptions testify that taxes were collected in Babylonia, Egypt, and other countries of antiquity. In Europe, during the Middle Ages, most governments were sup-

ported chiefly from the income of lands owned by the government (public or national domain) or by the ruler himself; there were some regular taxes and numerous special fees, but a state system of taxation was practically unknown. In the European cities of the period, however, local taxes were collected with system and regularity.



A TATTOOED BURMESE BOY
Photo: Usual Education Service

Adam Smith, in his *Wealth of Nations*, lays down the maxims that a satisfactory system of taxation should conform to the principles of equality, certainty, convenience, and economy. These well-known maxims are still generally accepted, though in their application to industry they call for certain adaptations. Professor Bastable in his work on *Public Finance* suggests as principles for guidance that taxation should be (1) productive, (2) economical, that is,

inexpensive in collection, and of a nature to retard as little as possible the growth of wealth, (3) justly distributed, and (4) elastic. Simplicity should also be a fundamental feature of any system of taxation. The man in the street should be able to understand quite clearly how the taxes are levied.

The principal sources of State revenue in Great Britain are income tax and surtax and estate duty, generally known as *direct taxes*, and customs and excise duties, commonly called *indirect taxes*. A tax which is not regularly shifted, but is borne by the person on whom it is imposed, is a direct tax; whereas a tax which is regularly shifted, by the person on whom it is imposed, upon others who eventually pay it, is called an indirect tax.

Direct Taxes. The simplest kind is a *poll tax*, literally, a tax per head. Such a tax is levied upon individuals without reference to their property or employment. It was once an important source of revenue in many countries, but has been largely abandoned. The most important form of direct tax in operation to-day is that levied on incomes (see **INCOME TAX**). A direct tax such as the income tax has several advantages. It is easy to levy and cheap to collect. The taxpayer knows exactly how much he will be called upon to pay. Its chief disadvantage is the question of assessment. What constitutes a just basis? It has in addition the psychological disadvantage arising from the fact that many taxpayers would much prefer to contribute their share of taxation indirectly, not knowing exactly how much they have paid.

Indirect taxes are a main source of revenue for all national governments. They include, chiefly, duties imposed on imported goods (customs duties) and taxes on the manufacture or sale of certain commodities (excise duties). For example, the cigarette manufacturer in England has to pay a large tax upon the tobacco he imports. He indemnifies himself by charging a price for his cigarettes that will adequately cover the amount of tax that he has paid. In other words, a tax on commodities is generally borne by the consumer. In favour of indirect taxes are the facts that they are simple to collect and that they reach people who would otherwise pay no share of our country's taxation—the navvy, for example, who pays taxes on his beer and tobacco. Moreover, the revenue that they provide can usually be increased quickly by a further imposition. Finally, the taxpayer can more conveniently pay his taxes in small instalments than in a lump sum.

Against indirect taxation the chief argu-

ment is the fact that it is not fairly imposed. A tax on beer, tea, and sugar, for example, may create a heavy burden for the poorer classes, and yet not be felt at all by those who are in a better position to pay taxes. Other disadvantages are the uncertainty of its yield, which will depend entirely upon the amount of the commodity consumed and the inconvenience caused to trade.

Taxation in Practice. Taxation may be divided into the three classes. National Taxation, that is, taxation for the purpose of carrying on the general function of government; Social Taxation, for such purposes as National Health Insurance, Old Age Pensions, and Unemployment Insurance; and Local Taxation, or the levying of rates to meet the cost of local amenities and responsibilities. (See **RATE**.) Local rates are usually levied upon the basis of fixed property, i.e. land and houses.

The chief defect of the local system of taxation is its inequality, as regards both individuals and districts. Householders in one district may pay much more than their friends in a neighbouring vicinity. Moreover, owners of property occupying a large area of land space have to pay huge rates annually, whereas a stockbroker occupying a small office may possibly be exempt altogether.

National and social taxation, as mentioned above, are matters of central government, and are composite in nature, that is, composed partly of direct and partly of indirect taxes. See **CUSTOMS DUTIES**.

TAXICAB. See **CAB**.

TAXIDERMY (Greek *taxis* arranging, *derma* skin) The art of preserving and mounting the skins of animals.

Accurate measurements of the skin are made, and a drawing is worked out which shows the position of muscles, ribs, and hollows. This copy is used as a guide. Next a model corresponding to the body of the animal is constructed by covering a framework with clay, plaster, or papier-mâché. The skin is next removed from the body, and is treated with a preservative compound. Finally, the skin is put on the model, and is sewn at the points where slits were made in stripping it from the body.

TAYGETA, *tay t'et a*. See **PLEIADES**.

TAYLOR, JEREMY (1613-1667) A famous English preacher and author, born at Cambridge and educated at Caius College. After he had gained the favourable notice of William Laud, he was accorded a fellowship at All Souls', Oxford, and was made chaplain to Charles I. To the Royalist cause he remained loyal throughout all the years of the Civil War, which ended in the execution of the king in 1649.

For a time he was imprisoned in Wales, and after his release remained in that country, engaged in teaching and in writing some of his best work.

At the Restoration, he was made Bishop of Down and Connor, in Ireland.

His most famous works are *The Liberty of Prophesying*; *Great Exemplar*, a History of Jesus Christ; *Holy Living*, and *Holy Dying*. These, as well as his sermons, are written in a clear and vivid style, and abound in poetic imagery and evi-



JEREMY TAYLOR
Photo: Brown Bros.

dences of a rich and fertile imagination.

TAYLOR, ZACHARY (1784-1850). An American soldier and twelfth President of the U.S.A. It was his reputation as the hero of the Mexican War that was the decisive factor in making him President. His courage and fine judgment ensured the success of his brief administration in spite of his lack of experience. Probably the most important event of the presidency was the conclusion of the Clayton-Bulwer treaty between Great Britain and the United States for the promotion of the Panama canal. He died sixteen



ZACHARY TAYLOR
Photo: U. & U.

months after his inauguration.

TAY, RIVER. See PERTSHIRE

TCHAD, LAKE. See CHAD.

TCHAIKOVSKY. See TSCHAIKOVSKY.

TCHEKHOV, *chek' of*, ANTON PAVLOVICH (1860-1904). A Russian dramatist and novelist, commonly regarded as the greatest produced by that country. A serious writer, Tchekhov's works have almost a morbid quality, for his heroes and heroines appear inevitably doomed to suffer with overwhelming intensity from wounds inflicted by the uncaring, unfeeling mass; they are the targets of the slings and arrows of fortune. Few writers had a better understanding of Russian character, or so faithfully portrayed the decadent society of the pre-Revolution period. Although at the begin-

ning of his career Tchekhov had one or two minor reverses, it may be said that his merit was recognized with his first publication, *Parti-coloured Stories* (1886).

Among the most celebrated of his plays may be numbered *Ivanov*, *Uncle Vanya*, and *The Cherry Orchard*. Other prose works include *My Life*, *The Teacher of Literature*, *The Ravine*, *The New Villa*, and *The Lady with the Dog*.

TEA. A beverage brewed from the leaves of an Oriental evergreen tree. Its two principal constituents are caffeine and tannin (see those titles). The former is mildly



TEA PICKERS

Tamil women resting under Areca palms on the estate of Lipton's Ltd. at Polzahawela, Ceylon.

Photo: U. & U.

stimulating in small amounts, but produces injurious effects on the nervous system when taken in large quantities. Tannin is a poisonous principle, and it is not extracted by water, except when boiling is carried on for a long time. If boiling water is poured on the leaves, and the tea poured as soon as it has acquired the desired strength, the beverage will not have the bitter taste of tannin.

The Tea Plant. Under cultivation, the tea plant, which belongs to the same family as the camellia, is a branching shrub from 2 to 6 ft. in height. On tea plantations, it is kept to small size by constant pruning, for the

purpose of increasing the number of leaves, but in its natural state, it grows as a tree 30 ft. or more in height. The tea gardens or estates are planted with small bushes 4 or 5 in. high, which have been grown from seeds in nurseries. The small plants are set close together in rows, sometimes as many as 1500 to the acre. At the end of three years, a bush begins to be commercially profitable, but does not produce a full crop for at least two years more.

The chief tea-growing countries are India and Ceylon, the Dutch East Indies, China, and Japan and Formosa. An abundance of rainfall and a hot climate are especially favourable to the production of this plant. In Japan and China, the plants are grown in comparatively small gardens, but in Java, Ceylon, and India, there are vast estates, some of which produce more than a million pounds of tea a year. In Ceylon, India, and Formosa, where warm weather always prevails, picking may occur once a month; in cooler climates, two to four times a year.

The leaves of the plant are long and leathery, somewhat resembling those of the willow tree. The finest quality of tea is yielded by the young, tender leaves closest to the end of the branches.

Preparation for the Market. Picking is done entirely by hand. The leaves are taken to the factory for curing. Green tea is what makers call *unfermented tea*, and the black

is *fermented*. Fermentation, in this instance, means practically the same as oxidation—the leaves remaining in the open air from twenty to thirty hours. In the case of fermented tea, certain oxidizing ferments in the leaf are permitted to remain in it.

In black-tea preparation, the freshly plucked leaves are placed under cover on bamboo, canvas, or wire-netting trays, and left there for a day or two, to wilt. After this, they are crushed by being passed through powerful rolling machines, a process which brings the natural juices to the surface. The leaves are then spread out on tables in cool, well-ventilated rooms to ferment, after which they are again rolled, and then dried in the firing machines. Cutting machines now break up the pieces into uniform lengths, and the tea is finally sifted, graded, and packed for shipment. Green tea is fired twice, the second firing occurring as soon as the leaves are taken from the rolling machines. Some teas are artificially scented by exposure to fresh flowers.

The tea exported each year amounts to nearly 800,000,000 lb. Japan and Formosa, Ceylon and British India supply the greater part of the English demand for black tea. China produces both green and black.

It is known that tea was used as a beverage in China as early as the sixth century, and was extensively cultivated in Japan in the ninth, but its virtues were unknown to



TEA PLANTATION IN CEYLON



JAVANESE PICKERS STARTING FROM THE FIELDS TO THE SORTING SHEDS

Photo Visual Education Service

Europeans until the seventeenth century, when it was introduced into Europe by Dutch adventurers.

The tea industry began in British India about 1834, under the auspices of the East India Company, whose monopoly of tea was abolished the same year, but the Dutch preceded the English in this field, for experiments in tea culture were made in Java as early as 1826.

TEAK. A forest tree of the verberna family, native to South-eastern Asia. It is the source of a wood used in shipbuilding and furniture-making. The special qualities of teakwood are strength, durability, and resistance to water; in addition, it is easily worked, takes a high polish, and contains a resinous oil that makes it resistant to insects. In appearance, the wood resembles coarse mahogany. Teak trees sometimes grow to be 200 ft. in height, and are generally found in groups in forests of other trees. The leaves, which are often 2 ft. long and a foot and a half in width, yield a purple dye, and are also utilized for thatch and wrapping material.

Scientific Name. The Indian teak belongs to the family *Verbenaceae*. It is *Tectona grandis*.

TEAL. See DUCK.

TEAPOT DOME SCANDAL. See HARDING.

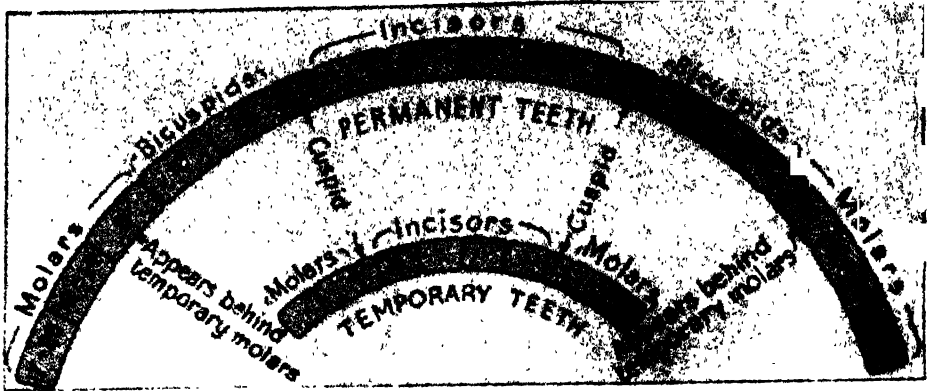
TEASEL, te's'l. The common name of a genus of plants containing one commercially

valuable species, the *fuller's*, or *clothier's*, teasel. This plant, which is native to the south of Europe, is used to raise the nap on cloth. The parts employed for this purpose are the heads of the tubular pale-lilac or white flowers. These heads are cut in two and attached to a cylinder which is made to revolve against the cloth. It is a thistle-like herb, with long, stemless leaves, prickly stems, and stiff, sharp bracts surrounding the flower heads.

Scientific Name. The species described is *Dipsacus fullonum*, family *Dipsacaceae*.

TECHNICAL EDUCATION. See EDUCATION.

TEETH. Like the hair and nails, the teeth are outgrowths of the skin, the growth in this case taking the form of hard, shiny projections specially adapted for the work of cutting and tearing food, and of grinding it to a pulp. The tusks of the male elephant are really out-turned eyeteeth, the largest teeth possessed by any animal. The anteater (which see) has no teeth, but most vertebrates possess them. Man and most of the higher animals have two sets of teeth, a temporary and a permanent set. In the case of human beings, the first, or *milk*, set usually develops between the sixth and thirtieth months; and when the child is 2½ years old, it has twenty teeth. At the age of 5, the first of the permanent set begin to appear,



AVERAGE TIME OF APPEARANCE OF TEETH

The figures represent the age of the individual.

(From a bulletin of the United States Bureau of Education.)

but the last of these sometimes do not break through until the twenty-fifth year, the latest being commonly known as "wisdom" teeth, which are frequently poor in structure and deficient in hardness.

Names and Structure. There are thirty-two teeth in the permanent set of an adult, eight in each half of each jaw. In each half there are two incisors, one *canine* (called the *eye-tooth* in the upper jaw, because it is just below the centre of the eye), two *bicuspid*s, and three *molars*. The bicuspid's take the place of the temporary molars, but all of the permanent molars, twelve in number, are entirely new teeth.

Each tooth has three parts—the *crown*, that part seen in the mouth; the *root*, the part embedded in the jawbone; and the *neck*, or *cervix*, a narrowed portion between the crown and root.

The jaw is furnished with sockets called *alveoli*, into which the teeth fit. The various kinds of teeth differ considerably in regard to the shape of the crown. That of an incisor is shaped something like a chisel, with sharp, horizontal cutting edges, for the incisors are used to bite or gnaw off the food.

The *canines* (*dogteeth*) have thicker crowns, shaped somewhat like a cone, with a central point on the cutting edge. In the case of dogs and cats, the canines are very long and pointed, for with them these creatures grasp and hold their prey. The bicuspid's are not so long as the canines, and are somewhat cube-shaped. Each has an inner and an outer point, or *cusp*, on the cutting edge. Hence the name, which means *two-cusped*. The molars, or grinders (*millteeth*), are provided with large crowns, roughened in such a way as to adapt



them to crushing and grinding the food. The molars of the upper jaw have three roots; those in the lower, two.

The Nerves. In healthy teeth, a soft pulp, containing nerves and blood-vessels, fills a cavity known as the *root canal*, which extends through crown and root. Immediately surrounding the cavity, and making up the greater part of the bulk of the tooth, is a hard, bony, yet elastic, substance called *dentine*. This is covered on the crown with *enamel*, a tissue so hard that it will strike fire with flint. The root of the tooth is fixed in place by a thin layer of bone known as *cementum*, and at its tip is a narrow aperture, through which the blood-vessels and nerves of the pulp cavity enter. Exposure to the air of these delicate nerves, through decay of the outer parts of the tooth, is responsible for toothache.

Care of the Teeth. Because the mouth is moist and warm, accumulations of food particles, collecting in the spaces between the teeth, at the margin of the gums and elsewhere, encourage the multiplication of countless bacteria, which form acids on exposed surfaces of the teeth. These acids eat into the protecting enamel, and if no steps are taken to prevent further harm, ultimately cause the teeth to decay. To prevent this happening the teeth should be well cleaned daily with a tooth-brush.

Bad teeth are often a cause of disease elsewhere in the body, for cavities due to decay are a possible source of infection.

TEGNER, *teg' nair*, ESAIAS (1782-1846) A Swedish poet, born at Kyrkerud. He was educated at the University of Lund, Sweden. His first success as a poet came in 1808 with the writing of a stirring war song. Three years later, he was crowned by the Swedish Academy for his patriotic ode *Svea*.

In 1817 he wrote *Song to the Sun*. Later appeared the romance *Axel*, the delicate idyll, or pen picture, entitled *The First Communion*, translated in later years by Longfellow; and the poem *The Story of Frithjof*, based upon ancient legends of Northern Europe.

TEGUCIGALPA, *tē gu se gal' pa* Capital of Honduras (which see).

TEHRAN, *tē rah'n'*. See PERSIA.

TEHUANTEPEC, *tē wahn' te pek*. ISTHMUS OF. The narrowest portion of Mexico, comprising that part of the country lying between the Gulf of Campeche, an arm of the Gulf of Mexico, and the Gulf of Tehuantepec, a part of the Pacific.

TELEGRAPHY. Transmission of messages along wires by means of electricity (Greek *tele* afar, and *graphos* writer).

In 1753 an article in the *Scotsman's*

Magazine, signed C.M., suggested for the first time that messages might be sent by means of electric currents, and it is generally believed that this article was written by a Greenock surgeon called Charles Morrison; but it was not until 1809 that Sömmering, a medical student at Göttingen, demonstrated the possibility of an electric telegraph.

Sömmering used a separate wire for each letter of the alphabet and the whole thing was hopelessly cumbersome, but the underlying idea was, as it is to-day, to send electric currents, produced by a battery or a machine, and varying in some way for each letter, figure, etc., from the transmitting station along a wire to the receiving station. Here they are made to actuate apparatus in a different way for each variation of current.



MODERN KEY, SOUNDER AND RELAY
Photo. Western Union Telegraph Co

and thus allow the receiving operator to spell out the message by hearing, or by seeing, the working of the apparatus. The actual time taken for the currents to travel from the transmitting station to the receiving station is, for practical purposes, instantaneous for all systems, the speed of travel is 186,000 miles a second.

Sömmering's method was never put to practical use, but the epoch-making discovery of Hans Oersted in Denmark in 1820, that an electric current would cause a magnetic needle to turn on its axis, paved the way for the invention of practical telegraphy in 1837. In connection with this invention many names might be mentioned, notably Gauss, Weber and Steinheil in Germany, Laplace in France, Morse in America, and last, though not least, Wheatstone and Cooke in England, who, working together in 1838, installed the first practical telegraph in England, on the old London and Blackwall Railway.

In this first telegraph, four line wires were used, the signals being given by the deviation of magnetic needles by the electric currents. Its value was shown a year later when telegraphic intelligence led to the arrest of a murderer, called Tawell.

The Simplex Method: Wheatstone and Morse. In 1840, Wheatstone invented the first reliable ABC telegraph. This consisted of two dials for sending and receiving

respectively, on the faces of which were printed the letters of the alphabet, figures, etc. By pressing a button next a character on the sending dial, a current of electricity, produced by a hand-operated magneto generator, was sent along the line, and, at the receiving end, operated a pointer which stopped momentarily against the same character on the receiving dial. One of these instruments was still in use on a circuit in North Wales as late as 1930.

Meanwhile, many pioneers were at work, most prominent of all being the American inventor, Samuel Morse. By 1837, Morse had constructed, after great expense, his first practical apparatus, and in 1844 erected the first successful telegraph line in America using the Morse code, between Baltimore and Washington. The dot-and-dash system of signalling, known by his name, he also devised.

Transmission was confined for many years to sending the current in dots and dashes, using the Morse code, by means of a signalling key operated by hand, but in busy services, hand working proved too slow, and was supplanted by machine working, still using the Morse code.

For reception, non-recording apparatus was used for many years, the dots and dashes being read by looking at the movements of a magnetic needle, a swing in one direction representing a dot, and in the other direction a dash. Apparatus of this sort could deal with about thirty telegrams an hour. For commercial inland working it was soon supplanted by the *sounder*, which, in various forms, was used all over the world on lightly loaded circuits until quite recently.

The **Sounder** consists essentially of an electro-magnet which can attract an armature fixed to a lever that is pivoted and moves between two stops. When the current from the line passes through the electro-magnet, the lever is pulled down against the lower stop; when the current ceases, the armature is released, and a spring pulls the lever

against the opposite stop, the sounds being heard as the dots and dashes of the Morse code.

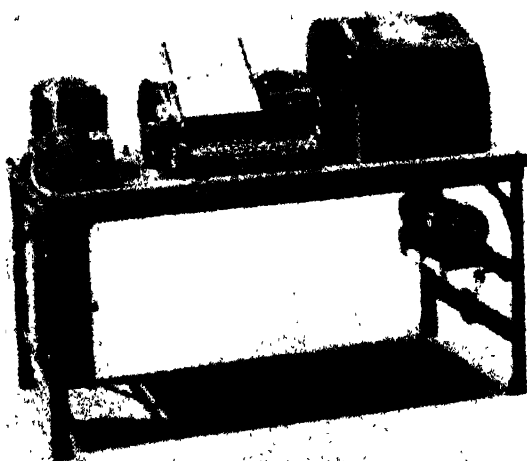
With skilled operators, the sounder was good for sixty telegrams an hour.

A recording instrument taking the form of an ink-writer was invented by John, an Austrian engineer, as long ago as 1835. It was on the lines of a sounder, so arranged that when the armature was attracted, the edge of a disc, revolved by clockwork and with its lower half dipping into an ink-well, was pressed against a paper tape carried

along by clockwork. If the disc pressed for a short time, a dot was made on the tape, if for a longer time, a dash. All Morse printers which have since been designed are developments of John's instrument.

Tape Machines.

In transmitting, hand operation was found to be not fast enough for busy circuits. The first machine apparatus used extensively in this country was the Wheatstone, which, in im-



TAPE PERFORATOR

The tape transmitter is on the left, the Monitor Teletype on the right.

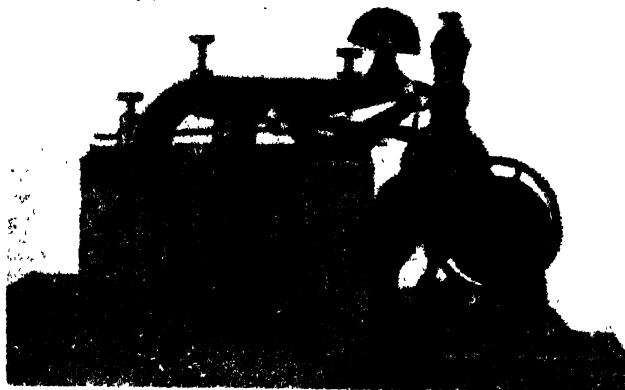
Photo Teletype Corporation

proved forms, was in general use up to 1926. The message to be sent is first punched upon a paper tape in the Morse code, a certain number of punched holes in the tape denoting a dot, and another number a dash. When the punched tape is passed through the transmitter by clockwork, rods press against it, and when they pass through the holes they make electrical contacts, by which currents are passed along the line in the form of short or long pulses, that is, as dots and dashes. The message is received in the form of dots and dashes in ink on the receiving tape, and is typed up in plain language on the telegraph form.

Wheatstone apparatus can deal with traffic at a very high speed, but much time is wasted in typing up the forms, and to obviate this trouble, F. G. Creed in England invented apparatus by which the messages can be received up to a speed of about 125 words a minute in printed characters on a gummed tape.

So far, simplex working only has been considered, that is, transmission of one message at a time over the circuit, but for very heavily loaded circuits in this country, the Wheatstone eventually gave place to the Baudot system, by which four messages could be sent and four received at the same time. With automatic transmission, this allowed of 400 words being dealt with in a minute. In this five-unit system, the messages were sent not in the Morse code but by a combination of five positive or negative impulses. Jean Baudot, a Frenchman, invented his original apparatus in 1874. Other notable Unit Systems were those invented by David Hughes and Donald Murray in England, and those of Siemens in Germany and the Western Electric Company in America, but in England the Baudot and Wheatstone reigned supreme until 1922, when they began to be superseded by the teleprinter, which is now in general use on all circuits, and is being rapidly adopted on the Continent. The United States was first

of Messrs. Creed. It has a typewriter keyboard for sending, and at the receiving end the telegram comes out typed on paper tape, ready for fixing on the message form, the speed of working being the same as for



THE MORSE RECORDER ON WHICH THE FIRST PUBLIC MESSAGE WAS RECEIVED

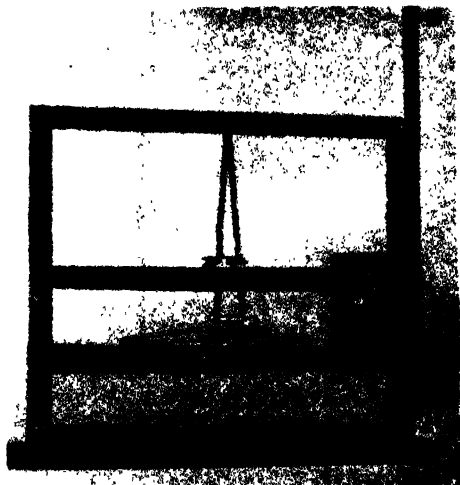
Photo: Western Union Telegraph Co

typing, say, sixty-five words a minute, and it can be used for simplex or duplex working. The great advantage of the teleprinter system lies in its combination of speed with simplicity of operation.

Much work has been done in the last few years on superposing telegraph channels on telephone channels, and this has resulted in what is called the voice frequency system of telegraph transmission. In this system the frequencies used in ordinary speech-transmission are broken up into a number of sections, each with a wave-band sufficiently wide to carry telegraphic signals. The installation of this system, which started in 1932, has resulted in a considerable reduction in the number of wires required for telegraph purposes, and has set free, for use as telephone trunk lines, many main-line cables just at the time when the telephone service was beginning to expand rapidly. By this arrangement four wires in an underground cable can provide eighteen telegraph channels, each working both ways.

In Britain, as in most other lands, the telegraph service is in the hands of the Post Office (which see). Important exceptions are the United States and Canada, where it is in the hands of commercial companies.

Telegraphing Pictures. This is a new and important development in telegraph working. The possibility of such a system arose in 1873, when May, a telegraphist at the Valentia cable station, discovered that the electrical resistance of selenium changed



MORSE RECORDER BUILT IN 1835

Photo: Western Union Telegraph Co

in the field with this type of apparatus in the form of what is called the Teletype, invented there by Charles and Howard Krumm.

The Standard Teleprinter is a product

under the influence of light, but it was not until the last decade that, by the use of valves and photo-electric cells, practical systems were devised. Pictures, photographs, drawings and all varieties of printed and written matter can be transmitted, but so far it has been used mostly, and that to only a small extent, for transmitting photographs for reproduction in the Press, though that a much wider field is possible may be realized from the fact that by this service 1000 written words could be sent to, say, Germany at about one-third of the normal cable charges. The Post Office in Britain is using the Siemens-Karolus-Telefunken system, the general principle of which is that, at the sending end, a ray of light scans in turn every spot of the picture or writing. This light is reflected into a photo-electric cell (the successor of selenium), connected to the line in such a way that currents in the line vary in strength according to the intensity of the light on the cell, and this intensity varies according to the tone of the spot on the picture from which it emanates. Currents are thus passed to the line varying with the tones of the picture, and, by a reverse process, these produce a copy of the picture at the receiving end.

In 1885 the telegraph service was showing signs of paying its way, but in that year the House of Commons, against the advice of the Government, introduced the old sixpenny twelve-word telegram, since when the service has never shown any signs of being a financial success.

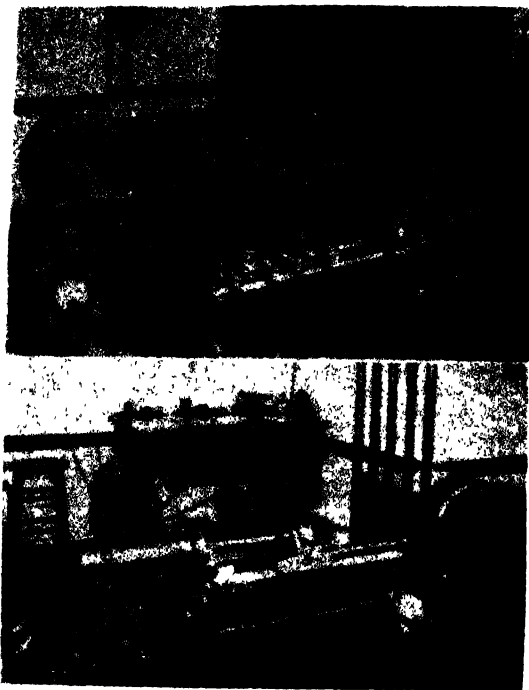
Telegram Finance. The advance of the telephone has hit hard at the telegraph, whose traffic fell steadily from 69 million telegrams in 1924 to 45 million in 1934.

when the deficit was £641,000. The sixpenny nine-word telegram was introduced in 1935 and increased the number of telegrams by 30 per cent, but at the expense of an increase in the deficit.

Submarine Cable Telegraphy was used in 1838 by Dr. O'Shaughnessy, afterwards Sir William O'S. Brooke, for sending messages across the River Hughli in India, and about the same time, Morse was sending

messages across the harbour at New York. Two Englishmen, the brothers Brett, laid the first cable across the Channel from Dover to Calais, at their own expense, in 1850.

Then came the struggle to bridge the Atlantic. The Bretts, backed by Cyrus Field of America, had the good fortune to enlist the help of a young English electrical engineer, Charles Bright, afterwards knighted and generally known as "the father of the Atlantic cable." The driving power of Field, the experience of the Bretts, and the technical ability of Bright, were soon supplemented by the



SENDING PHOTOGRAPHS BY TELEGRAPH
Apparatus for transmitting (above) and receiving
Photos: American Telephone and Telegraph Co.

genius of William Thomson, one of the world's great scientists, later Lord Kelvin, an Irishman of Scottish descent. Unsuccessful attempts were made in 1857 and 1858, but the next expedition, after experiencing terrible weather conditions, succeeded in their task on 5th August, 1858. The cable only lasted for two months and the next attempt was made with the help of the *Great Eastern*, the largest ship afloat, but again the cable broke, and it was not until 27th July, 1866, that a satisfactory cable was laid.

There are now eighteen cables between Great Britain and North America, sixteen being operated by one or other of the two great American Companies, the Western Union and the Commercial Cable Companies

(which work the inland telegraph systems of the United States of America and partly those of Canada), and two by the British combine of companies, called Cable and Wireless, Ltd. There are also four French, one German and one Italian cable between Europe and North America. The Cable and Wireless Company is the largest and most important cable organization in the world, and operates cables connecting Great Britain with India, Australasia, Africa and America. The short-distance cables between England and the Continent, with a few exceptions, are operated by the Post Office.

Owing to the electrical properties of a long submarine cable, signals were not only more attenuated than in the case of a land line but were also far more distorted, so that a special receiver, called the Syphon Recorder, was designed by Lord Kelvin. Improvements in the form of the cable itself and in technique generally have resulted, in recent years, in the introduction of equipment, for both sending and receiving, similar to the apparatus used on inland telegraph circuits.

Advances in cable technique were indeed slow, compared with inland working, until after the War, when the competition from wireless circuits began. Outstanding improvements are the introduction of the loaded cable, making use of Permalloy, Mumetal, or other suitable alloys for cable construction, which allow of high-speed working, and also the tapered loaded cable, which allows of high-speed duplex working, and has made technically possible, though not yet financially attractive, telephone working over long-distance submarine cables.

TELEMACHUS, *tel em' a hus*. See ULYSSES.

TELEPATHY, *te lep' a the*. The influencing of one mind by another at a distance, without the use of ordinary means of communication. Telepathy rests upon clairvoyance for its foundation. It has been stated, after extended investigation, that in most cases there is some means of communication which the observer is not able to detect, for when the persons are in separate rooms, the instances of success are no more than can be accounted for by chance. See PSYCHICAL RESEARCH.

Those who accept the hypothesis of telepathy make use of it to account for warnings and messages from distant friends, in times of special stress or danger, and to account for other similar phenomena. There is, however, much difference of opinion on the validity of the hypothesis.

TELEPH'ONY (from Greek *tele* afar, *phone* voice). In 1820 the Englishman Wheatstone, one of the greatest of telegraph pioneers, invented what was called "the

enchanted lyre." This was a stringed instrument, connected to a musical box by a long rod. The rod and the box were hidden from view, and the lyre was set in vibration by the rod connection from the musical box. When perfecting this toy, Wheatstone saw the possibilities of transmitting speech by electricity and made some groping attempts at a microphone, but he soon turned off to telegraphy. Nothing further of any moment was done towards telephony for forty years, when Phillip Reiss, a German electrician, put into practice an idea which Charles Bourseul, a Frenchman, had suggested, unknown to Reiss, a few years before. Reiss used, rather appropriately, a hollowed-out bung of a beer barrel for his transmitter, with a sausage skin for the diaphragm. When the skin was vibrated by sound waves, a piece of metal fixed to it caused interruptions in an electric current which was flowing along a wire from the sending to the receiving end. The receiver consisted of a coil of wire wound round a knitting needle on a sounding board, arranged in such a way that the interrupted current flowing through the coil vibrated the needle so that a sound, similar to that made at the sending end, was produced. Reiss was able to transmit noises, and to some extent, music and even vowel sounds, though not articulate speech. The honour of being acknowledged universally as the inventor of the telephone is reserved for the Scotsman, Alexander Graham Bell.

Before passing on to the triumph of Bell, however, there are two names which should not be omitted; Royal House and Elisha Gray, both Americans.

House patented, before Bell, an electric-phonetic telegraph which was capable of being used as a telephone in much the same way as Bell's apparatus, but he did not realize its possibilities. Gray filed his specifications of a telephone a few hours after Bell, and he brought an action for priority in the courts, but the Supreme Court in the United States of America upheld the prior rights of the Scotsman. Gray took out some fifty patents concerning telephones, and is amongst the greatest of telephone pioneers.

The Work of Graham Bell. Bell's father taught, in Edinburgh, lip-reading for the deaf, his son, Alexander, assisted him. Two other sons died of consumption, and Alexander, at the age of 24, was threatened with the same disease, so his father, in 1872, took him to Canada for a change of climate. After two years in Canada the son removed permanently to Boston, and quickly became a prominent figure in teaching the deaf. Before long, he met Thomas Sanders, whose son was deaf, and Gardner Hubbard, whose

daughter was deaf. Bell was most successful with both pupils and later married Miss Hubbard, and their fathers combined to help him financially with his electrical experiments for speaking over wires. He was fortunate in enlisting at once the help of a young American electrician, Thomas Watson, without whose enthusiastic assistance it is quite likely that Bell's great idea of the speaking telephone would have come too late. At the end, after months of tireless



SWITCHBOARD OF 1882

This lamp-shade switchboard served to connect the twenty-five subscribers of the Southern Bell Telephone and Telegraph Company and had capacity to cope with two hundred

Photo - Keystone

experiments with what he called the "harmonic telegraph," Bell stumbled up against the principle of the speaking telephone. On 3rd March, 1875, Bell was granted what was said to be "the most valuable patent ever issued," and one, too, which gave rise to about 600 lawsuits. On 10th March, 1876, the first articulate sentence was passed over a wire by telephone. The message was from Bell to Watson, from one room to another, in a boarding house in Boston.

In Bell's telephone, the metal disc was vibrated by the voice, but did not, as in the case of Reiss's, make and break an electric current. Instead, by cutting lines of magnetic force, it produced currents which flowed along the wire to the receiver, where the reverse process took place: that is to say,

the currents at the receiver, by passing through the coils of an electro-magnet, varied a magnetic field, which set the receiving disc vibrating in synchronisation with the transmitting disc, and so produced sounds similar to those used at the transmitting end. The principle is the same at the present day, but the current is supplied from an outside source, and is varied by speaking into a microphone. Sound waves in air are thus made to produce variations in an electric current.

In August, 1877, Bell formed a company, but before very long sold out, and the commercial development passed into other hands. Bell, however, continued to work with success on the telephone and on many other electrical devices, till his death on 1st August, 1922, at the age of 75.

Hughes and Edison: the Carbon Microphone. The first great improvement to Bell's apparatus was the use of an outside source of current, and a microphone at the transmitter for varying its strength. The microphone was invented by the Englishman David Hughes, who generously refrained from patenting it. He demonstrated its action on 25th May, 1878, in London. The great American inventor, Thomas Alva Edison, invented a carbon microphone about the same time, but Hughes is recognized now as having prior claim.

The carbon microphone, which is still in general use, consists of two carbon discs forming the top and bottom of a box full of grains of carbon. If one of the discs is vibrated it agitates the grains, thus altering the electrical resistance, so that the strength of a current passing from one disc to the other, through the grains, will vary in accordance with the vibration of the disc, which is acted on by sound waves produced by the voice. Many forms of carbon microphone were invented, those produced by Francis Blake and the Rev. Henry Hunnings being much used in England.

In 1877 the first public telephone exchange was opened in New York. London followed suit in 1878. Exchanges were soon opened in all important towns in the United Kingdom, and there was much controversy on the merits of different forms of switchboards, but eventually the flexible cord type won the day, and is still the practice in all manual exchanges.

In 1880, when America had already forged ahead with 30,000 telephones against 5000 in Europe, the first trunk line, between Leeds and Bradford, was inaugurated. In 1892 the trunk system was taken over by the Post Office, and in 1912 the whole of the telephone system operated by the National Telephone Company was purchased by that



1. An engineer testing automatic switches. 2. Apparatus room in the Springfield (Birmingham) automatic exchange. 3. Underground cable repairs. 4. International Telephone Exchange, Faraday Building, London.

Photos G.P.O.

Department. In most other countries, too, the telephone system is operated by the Post Office, exceptions being the United States of America and Canada, where it is operated by commercial companies.

Thermionic Valve. The telephone was invented in the United States, and they have ever since led the world in its development, so much so indeed that most developments in other countries have been in the nature of modifications in American practice to meet local conditions. The Thermionic Valve (1905) however, which made long-range telephony possible, was invented by an English scientist, Professor, later Sir Ambrose Fleming. This promising new line of advance towards the amplification of weak signals led to the invention by Dr. Lee de Forest in America, in 1907, of the *Three-Electrode Valve*, which is, in all essentials, the repeater instrument used for the

magnification of signals in long telephone lines, and is familiar to all as the valve in broadcast receivers.

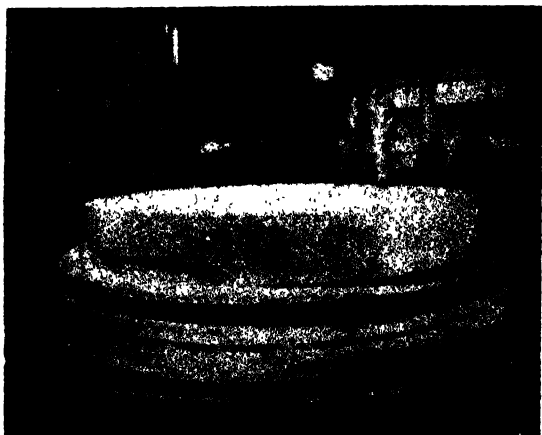
At the beginning of the century, Michael Pupin in America had invented the *loading coil*, which is still used, and which was a most important step toward improving long-distance working, but it was the valve which made possible the interchange of telephone conversations right across America, and between the most distant countries in Europe. It is worth noting that the loading coil, like the loaded submarine cable, was the outcome of the mathematical investigations of Oliver Heaviside in England.

Automatic Working. This was the next great technical advance; it is what Sir Ambrose has called "the nearest approach of machinery to the human brain." It was originated as long ago as 1886 by Almon B. Strowger, an undertaker of Kansas City, and

the system used in Britain was developed directly from Strowger's invention. The first public automatic exchange was opened in England at Epsom in 1912, and by 1935 there were 1627 in operation.

In 1891 England was connected to Paris, but the rest of Europe followed slowly till, in 1923, a standing international committee was formed to further international telephony in Europe, and by 1936 the only country not connected was Albania.

The number of telephone stations throughout the world is now over 32 millions, including over 11 millions in Europe and over 18 millions in North America. The only



TWO-HUNDRED INCH TELESCOPE MIRROR

It is nearly 17 ft. in diameter, 27 in. thick, and weighs 20 tons. Its size can be appreciated by comparison with the men standing on it.

countries with more stations than Great Britain, which has over 2½ millions, are the United States with about 17 millions and Germany with about 3 millions.

Great Britain is only ninth on the list when considered in proportion to population, the numbers, at the end of 1933, being, per 100 inhabitants: U.S.A. 13.3, Canada 11.2, Denmark 10.1, New Zealand 10, Sweden 9.5, Switzerland 8.9, Australia 7.4, Norway 7, Great Britain 4.8.

The Radio-Telephone Service. Telephone connection with Europe is still made by means of submarine cables from England to France, Belgium and Holland, but the Post Office also operates the radio-telephone service which connects this country to 38 countries in other continents. It was not until 1923 that the prospect of working commercial circuits by radio-telephony over great distances became reasonable, and the Post Office began experiments across the Atlantic in co-operation with the American

Telephone and Telegraph Company. These experiments resulted in a commercial service being opened between London and New York in January, 1927. It was on the 7th of February, 1926, that two-way conversation was held for the first time between England and the United States.

The radio-telephone transmitting station for these services is at Rugby, and the receiving stations at Baldock in Hertfordshire and Cupar in Scotland. These are connected by underground cable to the International Telephone Exchange near St. Paul's in London, adjacent to which is the Radio-telephone Terminal, where technical operators attend to the control and amplification of outgoing and incoming speech. Separate stations are used for the radio transmission and reception so as to facilitate the prevention of interference between the outgoing and incoming speech.

The stations at Rugby and Baldock are also used for a telephone service with a number of large passenger ships which are suitably equipped for the purpose, so that telephone subscribers on land can converse with their friends in any of these ships.

By means of this world-wide telephone network, emanating from the International Exchange in London, it is now possible for any telephone subscriber to converse with 95 per cent of the 32 million telephone subscribers throughout the world.

TELESCOPE. A magnifying device used for viewing distant objects, which has made possible the science of astronomy and altered man's conception of the universe. The origin of the telescope is disputed. Legend relates that Roger Bacon used such an instrument, but its actual invention is credited to Hans Lippershey, a Dutch optician, at the beginning of the seventeenth century.

Galileo, the Italian astronomer, was the first to bring out a practical instrument. He heard of Lippershey's invention, and made one of his own the next year. Galileo's first telescope was a crude affair, and the best one he was able to devise before his death magnified but thirty-three times. Nevertheless, he was able to discern four of the satellites of Jupiter.

Structure. The essential parts of a telescope are an *objective* (also called *object glass* and *object lens*) for the formation of an inverted but bright image of the object under observation, and an *eyepiece* for magnifying the image. These parts are set in a tube, so

constructed that the observer can lengthen or shorten the distance between them. Astronomical telescopes are of two types, refracting and reflecting. In refractors the objective is a large convex lens of long focus, and the eyepiece a convex lens of short focus. In reflectors the object glass is a concave



PRINCIPLE OF THE REFRACTING TELESCOPE

Explanation appears in the text

mirror which reflects the rays of light to a focus.

Terrestrial telescopes, which are constructed for viewing objects on the earth, have two double-convex lenses between the eyepiece and the objective, and, as the rays diverge from the inverted image, they cross and form an erect, magnified image. The inversion of the image in astronomical instruments does not interfere with the accuracy of observations, but the additional lens used for erecting the image causes a diminution of its brightness.

The great reflecting telescope of Lord Rosse, at Birr Castle in Ireland, was for a long time the largest of its kind in the world. Since 1914 it has been a possession of the South Kensington Museum of Science. The reflecting mirror of this instrument is 6 ft. across, but the telescope is surpassed in size by those of Mount Wilson Solar Observatory (8 ft. 4 in.) and the Dominion Observatory, both in the United States.

In 1934, a 200-in. reflecting mirror was cast in England for the California Institute of Technology, to be housed in Mount Palomar Observatory, southern California.

TELEVISION. Defined in simple terms, this is the word used to describe the process of being able to see, through the medium of electrical methods of transmission, the reproduction of images of living, moving or stationary objects situated at some distance from the observer. This term was made use of first of all by a continental worker and adopted by the British Patent Office in 1911.

Although early scientific workers were familiar with much of the theoretical side of the subject, it was left to John Logie Baird to give the world's first demonstration of true television in January, 1926, before members of the Royal Institution. Prior to

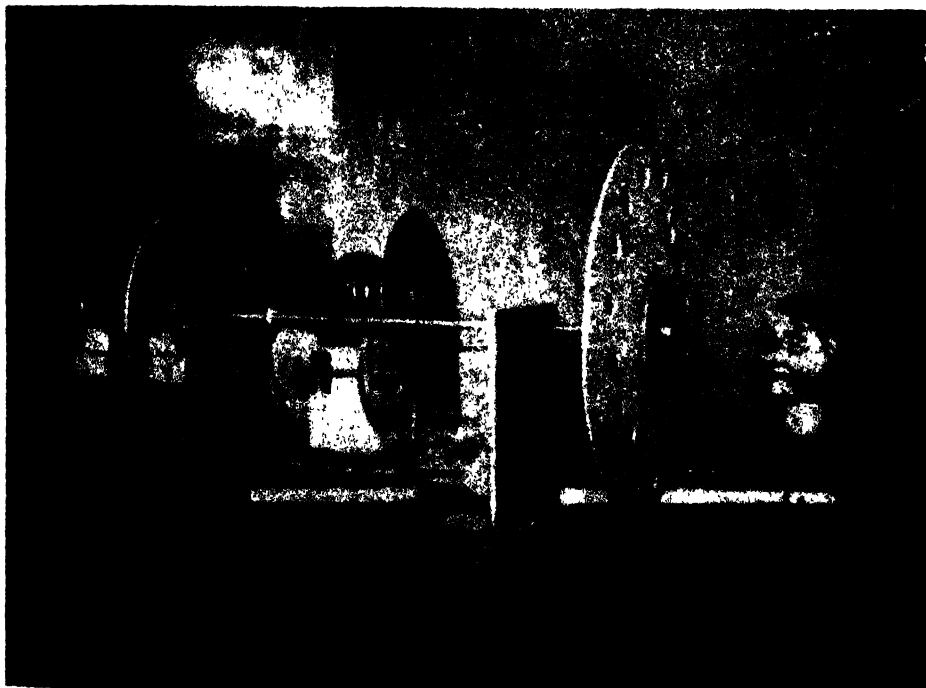
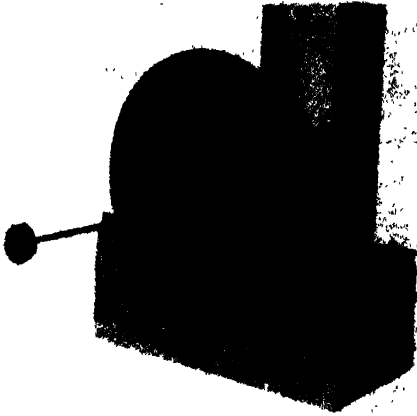


FIG. 1

The crude television scanner used by Baird for his first demonstration.



The original disk type of television receiver used in 1926

this, both Baird and Jenkins had transmitted silhouettes, but not until now had the human face, recognizable although crude, been seen with details of movement.

In Fig. 1, parts of Baird's first transmitter are shown, comprising a lens disc associated with a spiral and slotted disc driven from a small motor. The receiver is indicated in Fig. 2, being a solid disc with a single spiral trace of small apertures equiangularly spaced, the fluctuations of light intensity of a neon lamp mounted behind a frosted glass front being observed in order to reproduce the television picture. Fig. 3 is an untouched photograph of this early television picture as it appeared to the eye on the first "Television." This early equipment is now housed in the Science Museum at South Kensington.

In 1926, Baird demonstrated how objects in complete darkness could be transmitted by applying the principles of infra red rays, while in 1927 the American Telephone and Telegraph Co. staged a demonstration of television by sending television pictures by wireless between New York and Washington. In February, 1928, Baird was able to transmit recognizable television images across the Atlantic, the radio transmitter being at Coulsdon, Surrey, and the receiver at Hartsdale, a suburb of New York. Daylight, colour and stereoscopic television followed, but owing to the non-development of certain sections of the equipment the degree of definition was of a low standard.

In addition to the receivers which portrayed small images, steps were taken in England and America to show pictures on much larger screens for the entertainment of big audiences. For example, in 1932 the

English Derby was televised and shown on the screen of a cinema in London.

All over the world inventors were now concentrating on television development. Farnsworth and Zworykin in America invented apparatus devoid of any mechanical equipment, relying entirely on electronic methods for scanning purposes. A new technique was evolved for the transference of the signals by wireless, use being made of the ultra short waves, while on the receiving side the cathode ray tube, first proposed for this purpose by both Campbell Swinton and Boris Rosing in 1907, came into favour.

Analysing for Transmission. There are several methods, but in every case some form of "scanning" is required. With the human eye, the true sensation of sight is brought about by the light reflected from any scene being focused on to a mosaic of optic nerve cells which form the innermost coating of the eye. This retina excitation is conveyed to the brain, and since, strictly speaking, the individual cells have true dimensions, the eye conveys to the brain an enormous number of infinitesimally small



FIG. 3. THE FIRST TELEVISION PHOTOGRAPH
This is an actual untouched photograph of the image as it appeared on the screen of the first television.

images, each having a fine granular structure, the elements possessing varying light values.

In order to reproduce vision at a distance, means must be employed whereby this structure can be simulated and a method employed for analysing the light value of each section in turn. The conversion of this light analysis into an electrical signal is the next stage in the procedure, so that it can be transferred by wire or wireless to a distant point for reconversion into terms of relative brilliance. The unconscious scanning or exploring action of the human eye must be duplicated by television equipment.

One of the original schemes (still in use to-day) is the *light spot method* whereby a tiny area of intrinsically brilliant illumina-



FIG. 4

Before the television in the Baird experimental studio at the Crystal Palace

tion is made to move over the object in a series of horizontal lines, one after the other, each line traced being contiguous to the other. When the complete scan is finished the process is repeated, the rate at which this is done being governed by the number of complete pictures per second it is desired to transmit.

This light spot exploring process is carried out rapidly, and since it is continuous in action the photo-electric cells deliver a continuously varying output which is an electrical replica of the varying light values which make up the complete scene. As a rule the photo-electric cells are grouped round the subject being televised, and a reference to Fig. 4 shows how this is done. This shows the light spot studio at Crystal Palace, the moving beam of light passing through the glass window to scan the man standing before the five very large photo-electric cells. This disintegrating process (and subsequent re-integrating process at the receiving end) is carried out so rapidly (at least twenty-five complete pictures per second) that the eye is deceived into imagin-

ing that complete moving pictures are portrayed. This is because of the natural human phenomena known as visual persistence, whereby the eye retains an actual impression of the scene being watched even after the scene has disappeared. The most familiar example of this is the film at the cinema (which see). Fig. 5 shows a strip of cinematograph films.

The light spot method of tele-vision is restricted in its application. Another method is known as the *intermediate film*, whereby the interior or exterior scene to be portrayed is photographed on cinematograph film, and after rapid photographic processing to develop, fix and wash the negative, the film pictures are scanned for analysing the results into their component parts, as described earlier. Since the separate pictures are really a grading of shades on the sensitive emulsion, they can be projected on to

any flat surface by means of a small arc lamp. In this process the surface chosen is the top rim of a rapidly rotating scanning disc. Around the rim has been punched a circular trace of small apertures, all equally spaced. As each hole passes across the light-and-shade picture from the film projected on to the disc, it allows just that amount of light to pass right through it which is filling the hole area. This emerging light is focused on to a single photo-electric cell, and as the pictures are moving downwards across the disc face at a steady uninterrupted rate (generally twenty-five pictures per second), while each separate disc aperture moves



FIG. 5

A strip of cinematograph sound film. This can be televised by the tele-cine-scanner.

rapidly as a horizontal trace across the picture, the double motion causes a complete dissection of each picture into a series of horizontal lines contiguous one to the other. The resultant light variations from the pictures are in consequence analysed



FIG. 6

A German intermediate film scanner mounted on a van for covering exterior scenes.

and transformed to electrical signals by the photo-electric cell. The time of delay between photographing the scene and its actual translation into a television signal is only thirty seconds, and the equipment built up for this purpose is quite compact. (See Fig. 6)

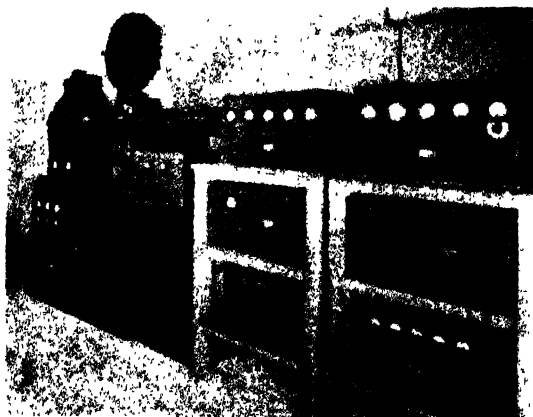
When it is desired to transmit any standard talking films produced by established studio methods, a talking film projector is adapted to use the disc scanner as described for the intermediate film process. This is shown in Fig 7 where on the extreme left is seen the arc lamp, while in front of this is the film mechanism with the interrupter shutter removed. The film pictures pass from the top spool chamber down through the "gate" at a steady speed and the resultant small pictures, projected on to the disc face, are scanned by the circular aperture trace, to be translated into electrical signals by the photo-electric cell and associated amplifiers shown on the right of the illustration.

"Scanning" Developments. There are now two improved forms of scanning, due to Zworykin and Farnsworth, in which no mechanical parts are necessary in order to bring about the picture analysis. The first, due to Zworykin, is called an *Iconoscope*, and for its operation depends on simulating the action of the eye to a degree not achieved by other devices. At the back of a large evacuated tube is a plate built up from a

mosaic of millions of tiny but quite separate and distinct photo-electric cells. This plate is manufactured by a chemical process, and the separate cells, together with a metal backing plate and a mica insulator, constitute an assembly of separate electrical condensers. By optically focusing the scene to be televised on to this plate, each cell acquires an electric charge in direct proportion to the measure of light stimulation it receives. Relatively speaking, the charge is large or small according to whether the cells are exposed to the bright or dark portions of the picture respectively.

To analyse this picture into its separate elements and so generate the television signals, a beam of electrons from a cathode ray tube (described in the next section) is made to move across this mosaic in an ordered series of separate lines, each one below the other. This has the effect of discharging each separate cell as the beam moves over it, and the result is a continuous but varying signal brought about by each current-discharge pulse from the condenser mosaic. Since every current pulse is the outcome of the original acquired charge from the optical picture, the resultant signal is an electrical facsimile of this picture which can be amplified and transmitted to the receiving end.

With the *image-dissector tube* developed originally by Farnsworth, the scene is focused on to a cathode surface placed at the back of a cylindrical glass tube. This



A modern scanner used for televising sound films.

surface has a uniform coating of photo-electric material, with the result that the optically focused scene, in terms of light gradation, produces an electron emission from the surface so that the density of the electrons at every point is directly

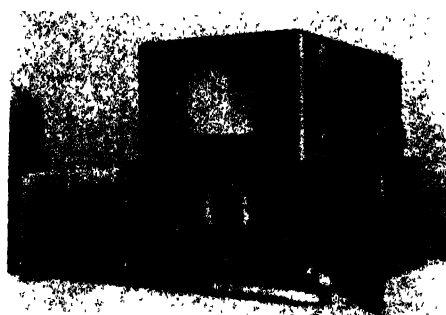
proportional to the light stimulation received. This electron emission is called an *electron image*, and owing to its negative electrical characteristic (an electron is a negative particle of electricity) it is possible to draw the whole image forward to the far end of the tube and keep it in focus by having a coil surrounding the tube. At this remote end of the tube is a small tube with an aperture, and behind the aperture is a collecting plate. Two pairs of coils at right angles to one another and just outside the glass tube cause the electron image to move bodily to and fro across the aperture in a series of lines by passing pulsating currents through the coils. This allows each part of the complete electron image in turn to pass across the aperture: the electrons flow through this hole and, being collected by the plate, generate a continuous but varying electrical signal which is proportional to the original light-and-shade gradation of the original scene. Wholly electronic scanning devices, such as have just been described, represent the most up-to-date practice.

The degree of definition into which every picture is analysed governs the amount of detail which can be portrayed, and the minimum for good results capable of giving sustained entertainment value for any public service is 240 lines. This is known as *high definition* to distinguish it from the early low definition methods which used only 30 lines. Due to this high definition, the resultant electrical signal comprises frequencies extending up to four million per second, and in consequence the only satisfactory way to convey this signal from the transmitter to the receiver is to use ultra short waves, that is, radio waves with a length below 10 metres. Unfortunately, these ultra short waves travel in much the same way as light rays and, in consequence, the range over which they can be received is restricted, at the moment, to approximately a 30-mile radius from the radio transmitting station.

Mechanism of Reception. A wireless set detects and amplifies the electro-magnetic waves with their television signal modulation, but instead of passing them to a loud-speaker they are made to modulate a cathode ray tube. The cathode ray tube consists of a cylindrical tube to which is attached a conical end terminating in an almost flat face. On the interior of this is sprayed a fluorescent screen. In the tubular neck is mounted a cathode or filament which is rendered active by passing a current of electricity through it. As in the case of any ordinary thermionic valve used in radio receivers to-day, the cathode becomes a source of agitated electrons, and many of these overcome the surface attraction, to be

liberated in the space immediately surrounding the cathode.

In front of this cloud of electrons is placed a metal disc having a small hole in the centre. By applying a high voltage to this electrode the electrons are drawn towards it, and through the medium of an electrical focusing device the bulk of the electrons pass right through the hole. Owing to the high velocity acquired by this action, the electrons proceed at great speed towards the front fluorescent screen in the form of a beam. Due to the "impact" of these electrons on the screen, a glowing spot of high intrinsic brilliance appears, and it is now necessary to make this spot execute an ordered scanning action



A modern television receiver using a cathode ray tube. Pictures are observed direct on the fluorescent screen.

which is an exact geometric duplicate of the scanning action taking place at the transmitting end.

This is carried into effect by either pulsating electro-magnetic or electrostatic fields, produced in the former case by two pairs of external coils, or in the latter case by two pairs of parallel plates at right angles to one another. The voltage variations fed to this section of the cathode-ray tube equipment are such that the spot moves from left to right at a constant velocity across the fluorescent screen and then returns almost instantaneously. With a combined horizontal and vertical motion imparted in this way, the field covered by the light spot is a series of lines one below the other, or in other words, a duplicate of the scan at the transmitting end. For an example of this type of receiver see Fig. 8.

To build up the resultant television picture the degree of brightness of the spot of fluorescence must be altered in exact accordance with the magnitude of the television signal, which of course was generated originally by the light gradations of the transmitted scene or object. The

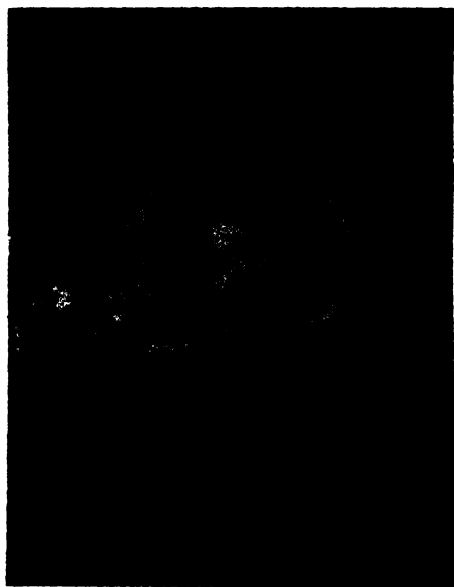


TELEVISION STUDIO

On the left is the orchestra screening curtain; the backcloth is designed for the ballet "Cleopatra"

Photo: B.B.C.

incoming signals are therefore fed to a control electrode which alters the electron density and, in consequence, the spot's in-



TELEVISION CONTROL ROOM

From right to left: engineers in the positions of projectionist, vision control and sound control.

Photo: B.B.C.

tensity during every moment of the movement. The picture is therefore built up in the manner required, and by carrying this out at a rapid rate it is possible to reproduce moving pictures which are a duplicate in small detail of what is happening at the distant studio.

TELL, WILHELM. A legendary hero of medieval Switzerland. He was a peasant of Uri, and in 1307, when the country lay under the rule of Austrians, he appeared in the market-place of Altdorf. Here, on top of a pole, the Austrian bailiff Gessler had set up a cap, to which he commanded all Swiss to do homage. Tell refused to humble himself, and was told that he would be put to death unless he could save himself by shooting an apple from the head of his little son. This feat he accomplished, but when he confessed that a second arrow in his quiver was intended for the heart of Gessler, had the first not hit the mark but had killed his son, he was seized and placed in chains.

While he was being carried across a lake in the bailiff's boat, a great storm arose. Gessler ordered the prisoner to be unbound, and to help steer the boat. Tell, when his chains were loosed, sprang ashore, and sent an arrow into the heart of his persecutor. This tale is the basis of Schiller's drama *Wilhelm Tell*, and of an opera by Rossini.

TELLURIUM, tel ú' rium. See **CHEMISTRY**.

TELLUS. In mythology, an Italian deity of "mother earth" who was honoured chiefly

as the personification of fruitfulness (like Demeter and Ceres), and was invoked by country people as their protectress against earthquakes. The springtime festival of the sowing was dedicated to her. She is apparently a "character" of the same earth-deity who was honoured under the names of Cybele, Rhea, Vesta and Gaea, and was, after Chaos, the most ancient of the divinities, being mother of Uranus (Heaven) and Pontus (Sea).

TEMPERA. A method of painting where the colours are bound by admixture with substances other than oils. The binding materials usually employed include egg yolk, size, or any glutinous substance. Botticelli and Titian and other master painters up to the present day, used and still use tempera for under-painting, if not for the finished work. To-day it is employed in admixture with dry colours.

TEMPERAMENT. See PERSONALITY.

TEMPERATURE. In physics, a term used to describe the state of a body with reference to its ability to communicate heat to other bodies. When two bodies are brought into contact, and one transfers heat to the other without the performance of work, as in refrigeration, it is evident that the one receiving heat has a lower temperature than the other.

In theory, there is a point at which the vibrations constituting heat cease, and this point (273° below Centigrade zero) is known as the *absolute zero of temperature*. In recent times a great deal of research has been devoted to the science of low temperatures, and to establishing the Thermodynamic Scale, the work of Professor F. Simon of Oxford being notable. The lowest temperatures obtained with certainty (apart from those calculated by extrapolation of Curie's Law) are within about $\frac{1}{16}$ of a degree from Absolute zero.

The temperature of the human body is normally 98.6° F.

Earth's Extremes in Temperature. Between the hottest and the coldest temperatures ever recorded in Nature, there is a variation of 231.4° F. The lowest weather temperature recorded, so far as is officially known, is at the 15,000-foot level on Mount McKinley, Alaska, where the self-registering thermometer has shown a reading of 95° below zero.

At the other end of the scale the Italian meteorological station at Azizia, in the semi-desert plain of Jefara, North Africa, registered 136.4° in the shade, on 13th September, 1922.

TEMPERING. The process of imparting to metals, principally iron and steel, a required degree of hardness. In industry,

the term is now almost exclusively restricted to hardening steel. Numerous methods of tempering are in use, but all depend upon the same principle—heating and cooling the metal. When iron or steel is heated red hot and suddenly cooled in water, it becomes hard and brittle. Cast iron is cooled so rapidly in the moulds that it is brittle. On the other hand, if allowed to cool slowly, the iron or steel becomes soft and flexible.

As the temperature rises, the polished surface changes colour. By experience, it is known from the colour when the required temperature is reached. The metal is then plunged into water. Oil or molten lead are also used for quenching steel, and they cool the metal more slowly, preventing the cracking that sometimes occurs in high-carbon steels when water is used.

The colours which are noted in the processes of tempering, and the finished tools of different hardness produced from the various colourings, are as follows—

Pale yellow (about 430° F.); hammer faces, planer tools, engravers' tools.

Straw yellow (about 460° F.), dies, drills, punches, etc.

Brown yellow (about 500° F.), plane irons, gouges, twist drills, and coopers' tools.

Light purple (about 530° F.), surgical instruments, augers, cold chisels.

Dark purple (about 550° F.); axes, springs, saws, screw drivers, and needles.

TEMPLARS, KNIGHTS A military and religious order founded at Jerusalem in 1119, by eight French knights who bound themselves by vows of obedience, poverty, and chastity, and took as their special work the protection of the Holy Sepulchre and the defence of pilgrims. The society grew rapidly in numbers, and in 1128 Hugh de Payans, one of the founders, secured with the help of Saint Bernard recognition and privileges from the Papal Council of Troyes. The knights followed the rule of Saint Benedict. Along with the special privileges granted the Order by the Pope and various European rulers, it acquired many rich landholdings. Secular priests were admitted, and subordinate members for the menial tasks. The knights went bearded and close-pollled, wearing red skull-caps and white mantles or surcoats, embroidered with a red, eight-pointed cross.

Much of the history of the Crusades is but a history of the Templars. Their personal bravery was remarkable, and during the long attempt to hold Jerusalem for Christianity, over 20,000 of them met death on the field. The Latin kings of Jerusalem gave them quarters in the palace built on the site of Solomon's Temple; from this fact, the knights took their name.

King Philip IV of France was jealous of the power and reputation of the Order and secretly made plans to suppress it throughout France. With the support of Pope Clement V he planned a campaign, which culminated in 1307 in the death, by torture, of the Grand Master and many knights, and, in the course of the next few years, the disbanding of the Order in most countries. Such of their property as was not seized by the sovereigns was turned over to the Hospitallers.

TEMPLE. Etymologically, "a place cut off," and hence denoting a building for religious worship. The earliest temples were probably caves in which were kept images of the primitive gods. The temple was often believed to be the home of the deity that was worshipped. See illustration on next page.

The Jewish Temple. The above was in a spiritual sense the belief of the Jews in connection with their famous temples at Jerusalem. There were in the course of their history three temples, all constructed on the same principle of an outer court or courts, a porch, and the actual "House," consisting of (1) the Holy Place and (2) the Holy of Holies. See TABERNACLE.

The first temple was built by Solomon on Mount Zion of white polished limestone. In the court stood the Altar of Burnt Offering, in the Holy Place the Table of Shewbread (which see) and the Altar of Incense, and in the Holy of Holies the Ark, the Pot of Manna, and Aaron's Rod. Solomon's temple was destroyed by Nebuchadnezzar in 586 B.C.

The second temple (called Zerubbabel's) was begun in 537 B.C., and completed in 516. It was less splendid than Solomon's. It was desecrated by Antiochus Epiphanes in 168 B.C., and plundered by Crassus in 54 B.C. The third temple (Herod's) was begun by him in 20 B.C., and took forty-six years to complete. It was a magnificent structure. It covered twice the area of ground occupied by Zerubbabel's building, and had two splendid courts, the outer court of the Gentiles, and the inner court. Within the priest's part of the latter was the "House" itself, containing the Holy Place and the Holy of Holies. It was destroyed by fire at the taking of Jerusalem by Titus, A.D. 70.

TEMPLE, SIR WILLIAM (1628-1699). An English statesman and author. He negotiated the "Protestant Alliance" between England and Holland. As an author, he is remembered chiefly for his *Letters and Memoirs* and for his essays, especially his essay on *Ancient and Modern Learning*. This essay involved him in a struggle with Wotton, and Swift came to his aid with *The Battle of the Books*.

TEMPO. A musical term meaning "time,"

derived from the Italian, and expressing the rate of movement in which a musical composition is to be played. Indications of time are divided into two classes—those which suggest the rate of movement, such as *lento* (slow), *adagio* (gently), *moderato* (moderately), *presto* (quick), etc., and those which represent a quality which may influence the time, such as *vivace* (lively), *animato* (cheerfully). See Music.

TEMPORAL BONES. Two of the eight bones of the head (which see)

TENANT-RIGHT. In law, the right of a tenant of agricultural land to certain compensation on giving up possession of the land at the end of his tenancy. The principle is that the tenant is entitled to be compensated for being unable to reap all the fruits of what he may have done by way of good husbandry for the benefit of the land. See LANDLORD AND TENANT.

TENBY. See PEMBROKESHIRE.

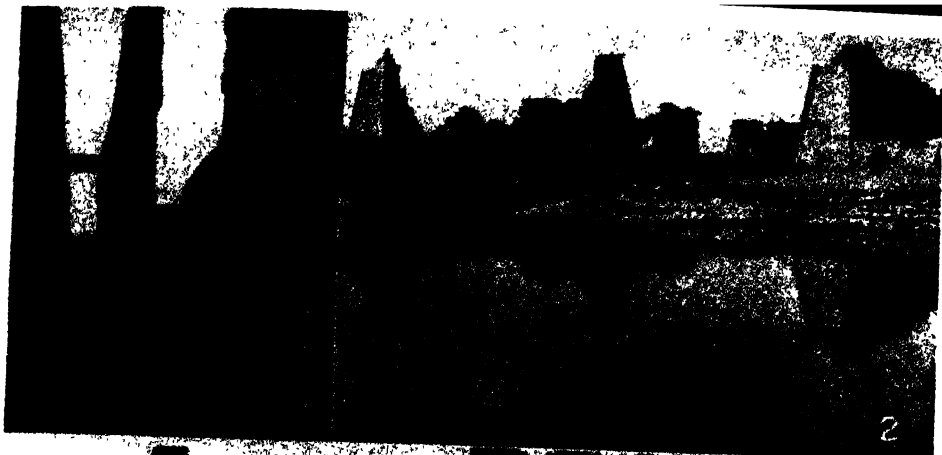
TENCH. One of the numerous members of the great carp family, the Tench is found in the slowly flowing rivers and muddy ponds of Europe and the southern part of Great Britain. It is noted for its shyness and for the fact that, like some other carps, it goes into semi-hibernation during the colder months. It lives close to the bottom, feeding on crustaceans and molluscs. The scales are small and closely set in the olive-brown skin—making the fish unusually smooth and slimy to the touch. Tench are edible and much esteemed as food in some countries.

Scientific Name. *Tinca tinca*.

TENDER. In commerce, a tender is an offer to make certain goods or perform certain services at a specified price. The usual commercial practice is for the firm which requires the goods or services to issue an invitation to several firms in that particular trade to submit their prices for the contract. In law, a tender is an offer of money or money's worth to a creditor in discharge of a legal obligation. "Legal tender" means money paid in a form which a creditor is bound to accept as payment. Bank of England notes are legal tender up to any amount, silver coins up to £2, and copper up to one shilling.

TENDON, OR SINEW. A strong fibrous cord, white and glistening, by which a muscle is attached to a bone or other structure. The longest tendon in the human body is that of a small muscle at the back of the knee, called the *Plantaris*, whose tendon, more than a foot in length, passes down to the back of the heel, and the stoutest is the *tendo Achillis*, which unites the powerful muscles of the calf to the bone of the heel.

TENDON OF ACHILLES. See ACHILLES.



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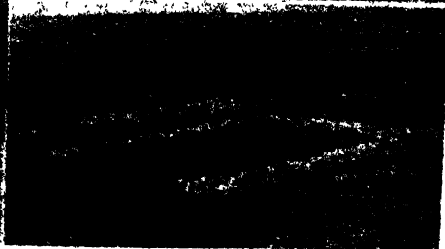
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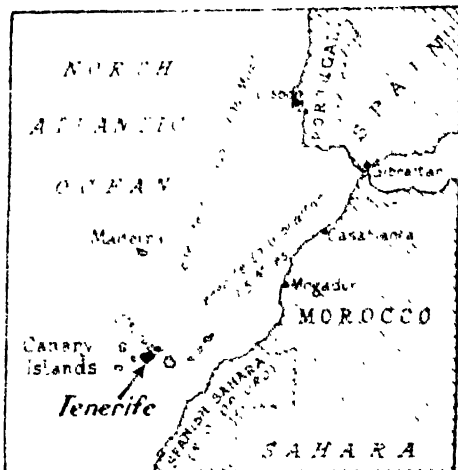


TEMPLES OF EGYPT, GREECE AND ROME

1. Papyrus pillars at Luxor. 2. Sacred lake and pylons at Karnak. 3. Temple of Castor and Pollux at Rome. 4. Temple on the Fasal Square, Olympia, Greece. 5. Temple of Nike Apteros, Athens. 6. Temple of Antoninus and Faustina, Rome. 7. Temple of Minerva at Syracuse, now transformed into a cathedral. 8. Part of the Temple of Dendera, Egypt. 9. Foundations of Roman temple at Maiden Castle near Dorchester, England.

Photos: George Lang

TENERIFE, *ten' er if'*. The name of the largest island and town of the Canary Islands (which see).



TENIERS, *ten' yez* (in French, *ten' yeh'*). The family name of two noted Flemish painters, father and son, both of whom excelled in the portrayal of scenes from everyday life.

David Teniers the Elder (1582-1649), was born at Antwerp. He was a pupil of Rubens. His paintings are noted for their fidelity to Nature, their charm of colour treatment, and excellence of composition. They include *Peasants Carousing in Front of a Tavern* (Darmstadt Gallery), *A Dutch Kitchen* (Metropolitan Museum, New York) and *Playing at Bowls* (National Gallery, London).

David Teniers the Younger (1610-1690), was called "the prince of genre painting." The younger Teniers was born at Antwerp and received his first art instruction from his father. In 1637 he married the ward of Rubens, Anne Breughel, and in 1651 he took up his residence at Brussels as court painter. Few artists equalled him in the charm with which he depicted scenes of rural life.

Among his canvases are *A Merry Repast* (Berlin Museum), *Peasants' Dance* (Pinakothek, Munich), *The Barber Shop* (in Cassel), and *The Card Players* (National Gallery, London). He was the founder of the Academy in the city of Brussels.

TENNESSEE, *ten' e see'*. A south-central state of the American Union with an area of

42,022 sq. miles and a population (1930) of 2,616,558, of whom over 18 per cent are negroes.

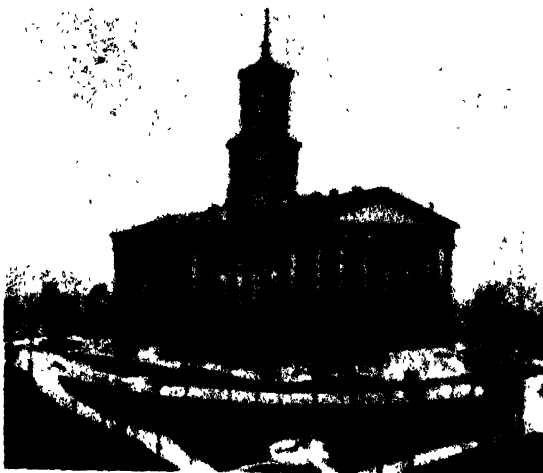
Only 34 per cent of the inhabitants live in cities and towns, the largest of which are Memphis (253,143), Nashville (the capital), (153,866), Chattanooga (119,798), and Knoxville (105,802).

Physical Features; Resources. From its mountainous eastern border, Tennessee slopes gradually westward to the bottom lands of the Mississippi River. Clingmans Dome, 6642 ft., is one of the highest peaks east of the Rockies.

Tennessee is an agricultural state. About 67 per cent of the area of the state is in farms, and over half of the population is engaged in agriculture. The alluvial river valleys are as fertile as any soils in the United States, and on such lands cotton, maize, and lucerne grow exceptionally well. Dark tobacco is grown in the northern counties. The grazing lands are world famous and produce some of the finest American racehorses and large herds of Jersey cows.

Coal is the most important mineral product of the state. Iron ores in workable quantities are found, and also copper.

Textiles and timber products lead the list of manufactured goods. Food preparations, flour and feed, cotton-seed oil, cake



STATE CAPITOL, NASHVILLE, TENNESSEE

and meal, tobacco, and snuff are other products.

TENNIEL, *ten' yel*, SIR JOHN (1820-1914). An English cartoonist and book illustrator, famed for political cartoons made for *Punch*, and for his inimitable illustrations that add so much to the charm of Carroll's *Alice in Wonderland* and *Through the Looking-Glass*.



WOODED FOOTHILLS; TYPICAL SCENERY IN TENNESSEE

Photo: U. & U.

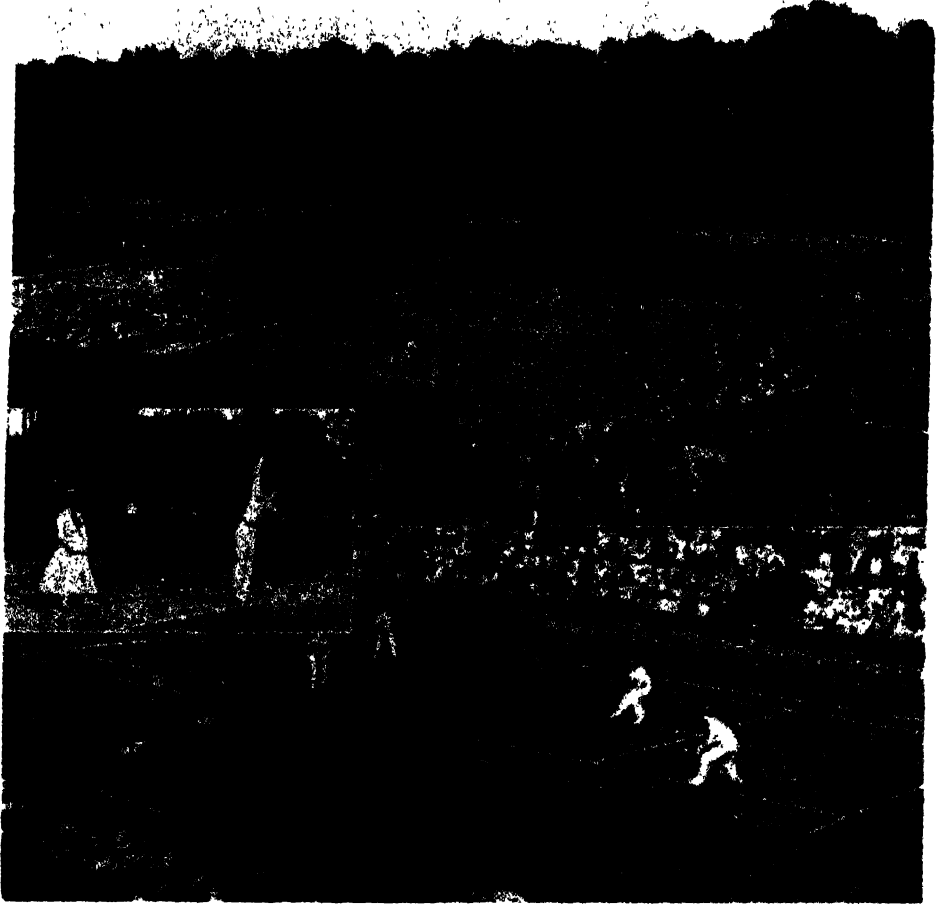
Besides the *Alice* books, he illustrated *Aesop's Fables*, Moore's *Lalla Rookh*, *The Ingoldsby Legends*, and various other works.

TENNIS. One of the earliest of ball games, whose origin is unknown. The old game was the basis for the modern game of *lawn tennis*, which is now generally called simply *tennis*. The old game of tennis was the popular sport of kings, and is sometimes referred to as the "royal game." There are yet a few of the old tennis courts in existence, and a number of others have been constructed, notably at Prince's and Queen's clubs, and at Lord's.

Lawn Tennis, the origin of which is still by no means certain, despite claims made for forerunners such as field tennis, long tennis and "sphairistike," has attained extraordinary popularity. It is played on a court of grass, gravel, cinders, clay, or asphalt,

with balls and rackets. The balls, approximately $2\frac{1}{2}$ in. in diameter, are of rubber, covered with felt. They are usually white. The rackets, which are 9 in. by 27 in., including the handle, have frames of ash or hickory, with cedar handles, the frames being netted with varnished gut. Steel frames are also used. The court is 27 ft., marked out by white tapes or lime boundaries, with an alley $4\frac{1}{2}$ ft. beyond on either side, used only when four people play. A net, 3 ft. high, divides the court into halves. Each side is divided again 21 ft. from the net, and the space between this line and the net is bisected into rectangles, called *receiving courts*.

Six games won make a *set*, unless each player has won five games, when a lead of two games must be won to complete the set. Three out of five sets for men, and two



LAWN TENNIS AT WIMBLEDON

Above: Singles matches in progress. On the court in the foreground McGrath (Australia) is advancing to the net to cut off a backhand drive from Purcell (Ireland). Inset: J. B. Ward and Miss M. Coles competing in the mixed doubles championship in 1911. Below: Hughes and Tuckey playing Allison and Van Ryn in the Davis Cup Challenge Round, 1935, on the Centre Court

Photos Topical. Central

out of three for women must be won to decide a major championship.

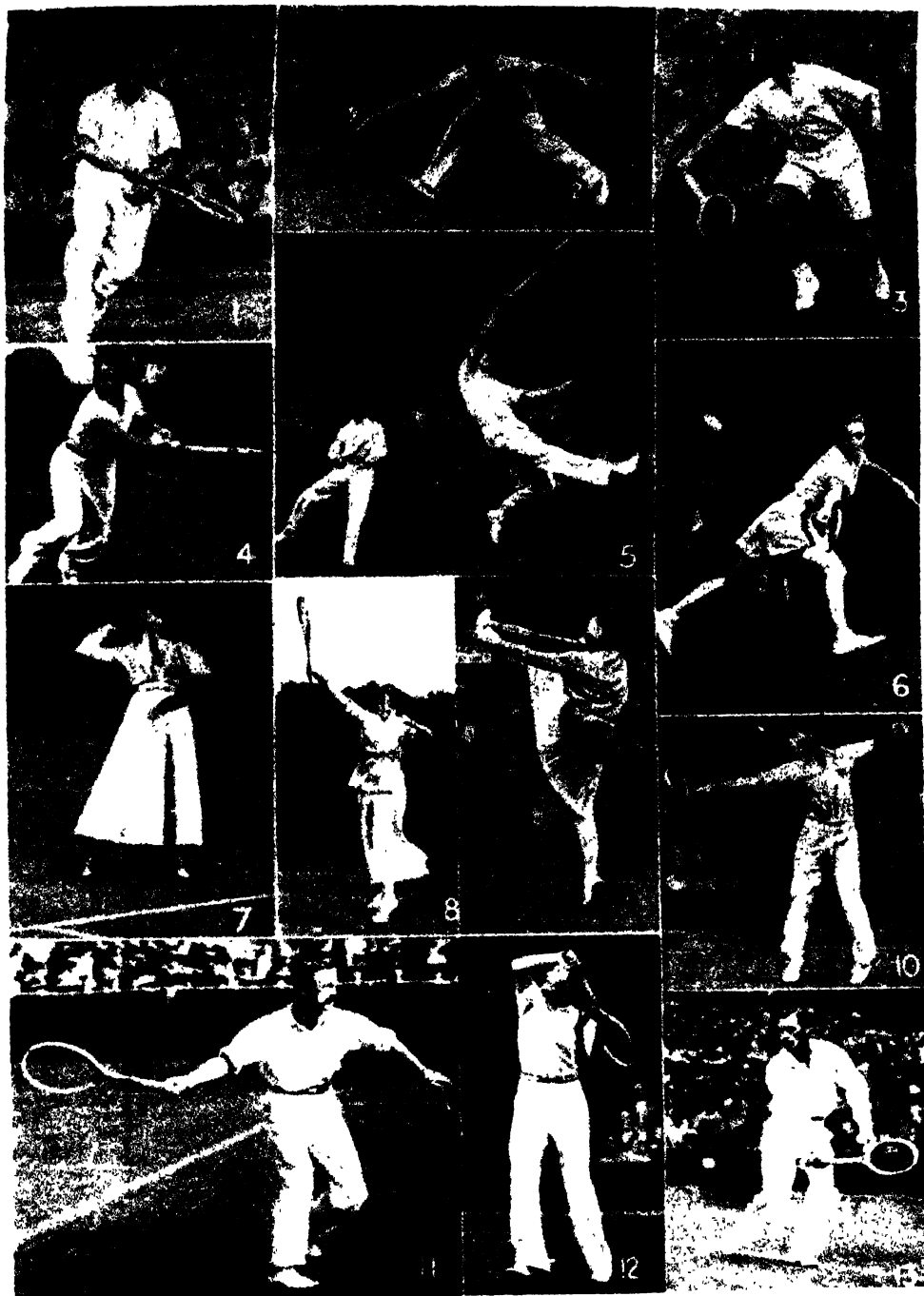
The world's singles and doubles championships for men and women are played each summer at Wimbledon, England.

In 1900, a cup was offered by Dwight F. Davis as a trophy for international competition. The United States won the cup in 1900, 1902, 1913, 1920-1926; Great Britain 1903-1906, 1912, 1933-1936; Australasia, 1907-1909, 1911, 1914, 1919; France, 1927-1932. Competition for the Davis Cup is by teams, not individuals. The Wightman Cup, established by Mrs. George W. Wightman in 1923, is a perpetual trophy offered for competition of women in England and

America. Matches, consisting of five singles and two doubles, are played annually, one year at Wimbledon, and the next at Forest Hills, Long Island. The United States won the cup in 1923, 1926, 1927, 1929, 1931-1936.

TENNYSON, ALFRED, FIRST BARON (1809-1892). Celebrated poet. He began writing at the age of eight, and in 1827 appeared *Poems by Two Brothers*, containing verses composed by him and his brother Charles.

In 1829 he went to Trinity College, Cambridge. His studies there proved uncongenial, but he gathered round him a number of literary friends, among whom was Arthur Hallam. In 1829 he won the Chancellor's



FAMOUS PLAYERS OF LAWN TENNIS IN ACTION

1. Crawford: finish of a forehand drive. 2. Perry: backhand low volley. 3. Austin: preparing for backhand low volley. 4. Grant: beginning of a backhand drive. 5. Brugnon (left) and Borotra (smashing). 6. Miss Jacobs playing a defensive backhand. 7. Mrs. Lambert Chambers serving (1911). 8. Miss Ryan: playing an overhead volley (1914). 9. Mlle. Lenglen smashing. 10. Vines: backhand volley. 11. A. W. Gore about to play a forehand drive (1909). 12. Von Cramm: waiting for a backhand smash. 13. Tilden: beginning a backhand drive.

Photos: *Topical; Central; Photopress*

medal for English verse with a poem entitled "Timbuctoo."

His next publication was called *Poems, chiefly Lyrical*, issued in 1830. This was



LORD TENNYSON
Photo Brown Bros.

followed in 1833 by the now famous volume of *Poems*, which includes some of his best-known work—"The Lady of Shalott," "The Lotus-Eaters," and others. The *Quarterly Review*, however, gave this book a harsh and unsympathetic review.

In the same year, 1833, a great tragedy befell Tennyson—the death of his friend Hallam. For the next ten years he published nothing, but was constantly engaged in reading and writing, until in 1842 appeared "Locksley Hall," "Morte d'Arthur," and several other characteristic poems. His reputation became nation-wide with the publication of "In Memoriam" (1850), which commemorated his friend Hallam, and is one of the greatest elegies in the language.

In 1850 Wordsworth died and Tennyson was appointed his successor as Poet Laureate. His first important work as Laureate was a lyrical-dramatic poem entitled "Maud" (1855). Meanwhile, he had turned his attention to the Arthurian legends, and in 1859 published "Idylls of the King," which were received by the public with great enthusiasm. Other well-known volumes followed: in 1874 *Enoch Arden* and in 1875 *Queen Mary*, a blank-verse drama. In 1883 he was made a peer.

The chief virtues of Tennyson's poetry are its melody and felicitous diction, nobility and sense of form.

TENOR. See CARPENTRY.

TENOR. Of the four normal voices of music, the lowest in pitch but one. Of men's singing voices, the tenor has the highest natural compass, the unnaturally high compass termed *alto* is also known as *counters tenor*. For the tenor clef, see Music.

TENSE. A word derived from the Latin *tempus*, meaning "time," and used in grammar to denote the forms which a verb may take to show the time when an action occurs. Tense is indicated by changes in the forms

of verbs and by auxiliary words, as shown below.

The following table gives the six simple tenses—

Present	I am, do, see, walk
Past	I was, did, saw, walked
Future	I shall be, do, see, walk
Present Perfect	I have been, done, seen, walked
Past Perfect	I had been, done, seen, walked
Future Perfect	I shall have been, done, seen, walked

Action in the present, past and future may also be represented as continuing, or in progress, and is then expressed thus—

I am doing, seeing, walking
I was doing, seeing, walking
I shall be doing, seeing, walking

The perfect tenses likewise have a form which shows that the action is continuous—

I have been doing, seeing, walking
I had been doing, seeing, walking
I shall have been doing, seeing, walking

Transitive verbs, like *to see*, may be conjugated in all tenses, in both the active and the passive voices. The passive forms are *I am seen*, *I was seen*, *I shall be seen*, *I am being seen*, etc.

Shall and *will* are both used as auxiliary verbs in forming the future tenses of the indicative. When used with the first person,



ALDWORTH, TENNYSON'S HOME AT HASLEMERE, SURREY
Photo Frith

both singular and plural, *shall* denotes simple futurity; when used with the second and third persons, it denotes command or necessity. *Will* in the first person, singular and plural, denotes purpose or intention, and in the second and third persons, simple future action.

The Infinitive. The infinitive has but two tenses—the present and perfect. The forms for both voices are as follows—

Present—to love, to be loved
Perfect—to have loved, to have been loved

TENSILE STRESS. See STRENGTH OF MATERIALS.

TENT. In general, a temporary covering erected by man to protect him from the weather. The first tents were made from the branches of trees and the skins of animals, and for thousands of years mankind rested and slept under the shelter of some form of tent, for they pursued a pastoral life and were forced to move with their flocks and herds in search of pasture.

In the progress of time, straw, hemp, flax, and silk were utilized in the making of the tent. Waterproofed canvas is now in general use. As man travelled and farmed and fought in larger numbers, the shelter of the tent was still a necessity even when small or large groups had made permanent settlements and built themselves huts and houses. The military camps were tent camps, as many are to-day. Ceremonial gatherings were formerly all housed in tents.

Tent-making became a skilled instead of a primitive occupation, and it is interesting to note that Omar Khayyam (or Khayyāmi), bears a name the second word of which means "tent-maker."

From the beginning of the present century there has been a remarkable development of the desire to live more in the open, and a recent estimate gives 14,000,000 as the number of motor-car travellers in the



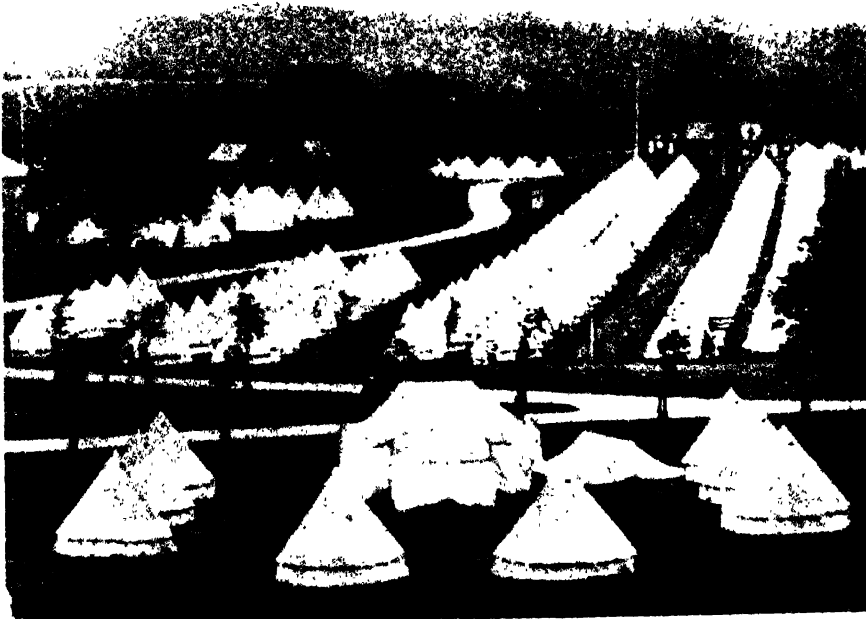
EXPLORERS' TENT

One of the tents used in the Arctic by the Scott Expedition. A sledge, stove, and other equipment are also shown.

Photo: Topical

United States of America who carry a tent on their cars and make camp-life their recreation. In England, also, camping under tents recently has grown in popular favour.

Tent Types. Tents are made in sizes varying from a few feet in diameter and weighing only about 3 lb. to marquees to cover hundreds of persons. Lightweight tents are often made of oiled fabric treated to prevent tackiness. The simplest forms can be treated with waterproofing prepara-



A TENT ENCAMPMENT

Military "bell" tents and marquee or "wall" tents are shown.

Photo: Topical

tions which render unnecessary the use of a fly-sheet. Bell tents are still popular, but there is greater use of "wall" tents, the larger of which are divided by partitions, according to the number of users and their requirements. In extensive territories abroad the "tepee" tent is used. For these, numerous poles, made from straight young timber, are used, and stacks of such poles are habitually left by campers for those who follow them. The tent roof or the pitch of the tent should be at an angle of at least 45°. In hot weather the position should be such as to provide shade in the afternoon. Wherever possible the tent should be pitched on a gentle slope so that, in heavy rains, the surface water will readily carry off, and the digging of a 6 in. trench round the tent is advisable.

TERBIUM. See CHEMISTRY (The Elements).

TEREDO, *tē re' dō* (SHIPWORM). Bivalve mollusc which bores into wood and feeds upon the triturated material and on microscopic organisms. They cause much damage of ships' timber and harbour woodwork as their burrows may be from a couple of inches to two feet in length. The creature is elongated into a worm-like shape. It has two rather small, deeply-notched anterior shells. It lines the tube with limy material.

TERENCE (PUBLIUS TERENTIUS AFR) (about 195-about 159 B.C.). A Latin playwright, born at Carthage and said to have been carried to Rome as a slave, and educated there by a Roman senator. His first play, *Andria*, gained for him admission into the best Roman society. His chief literary sources were the comedies of Menander and Apollodorus, which he freely translated and adapted. After bringing out six plays, he sailed for Greece, but never returned from the voyage; accounts vary greatly as to the manner of his death.

The ideal of Terence was artistic perfection, and the chief merit of his work is the perfect picture he has given of Greek life in the third century B.C., for his writings reflect little of the spirit of his own age and country.

His six extant comedies, probably representing all he ever wrote, are *Andria*, *Hecyra*, *Heautontimorumenos*, *Eunuchus*, *Phormio*, and *Adelphi*.

TERESA, *ter e' sa*, OR **THERESA**, SAINT (1515-1582). She was born at Avila in Old Castile, and in 1533 entered a Carmelite convent. Feeling the need for a greater asceticism and rigidity of conduct, she withdrew in 1562 and set up a new convent, where her ideas might be put into force. Opposition to her plan was strong, but the Pope sanctioned it, and finally the general of the Order

invited her to introduce her reforms into other convents.

For years after her death at Alva in 1582, several cities contended for her body, for it was held that miracles were worked where her relics were honoured. She was canonized by Pope Gregory XV in 1622. She wrote an autobiography and several mystic treatises, and left a large number of interesting letters, all of which were published in 1587.

TERMITES. The name given by scientists to an order of insects popularly known as *white ants*. Ants and termites, however, differ from each other structurally in important details. Termites constitute the order *Isoptera* (equal-winged insects). Ants



TERMITE (WHITE ANT) HILL IN AFRICA
Photo: Cherry Kearton

belong to the order *Hymenoptera* (membrane-winged).

Termites are found most abundantly in warm regions, notably in Africa, Australia, and the Amazon regions. Some species build huge mounds, made of bits of soil mixed with saliva. These nests are sometimes

15 ft. in height. The dome-shaped interior is divided into numerous chambers and galleries, and in the centre is a closed-in cell, where the king and queen are kept as prisoners. They are the only members of the colony capable of reproduction.

Termites feed on wood, paper, and other forms of cellulose, and are very destructive in their efforts to find their food, for they tunnel their way through the woodwork of houses and do great damage to sugar cane and orange trees. The treatment of woodwork in buildings with coal-tar creosote is an effective safeguard. About 1200 species are known, of which Europe has but two.

Scientific Name. Termites constitute the single family *Termitidae*.

TERNs. A large sub-family of sea birds related to the gulls and distinguished for their powers of flight. The fifty or more species are found in all parts of the world. They are commonly seen on sea coasts and along rivers and lakes, rather than in the open sea. Terns have long, pointed bills, webbed feet, and strong, large, pointed wings. They seize their prey, which consists of small fish, by darting quickly into the water, bill pointing downward. Great colonies of terns may be found on islands during the nesting season. The nests are usually placed in depressions in the ground, but sometimes the eggs are laid on the bare rock. During brooding the male bird usually feeds the female, sometimes the offering of food is a feature of courtship.

There are about ten species of terns on the British list, only three or four of which

coasts, and in the north these are replaced by the Arctic Tern. The last-named has the longest migratory flight of any bird known, travelling 22,000 miles in a year, from the



TERRA-COTTA STATUARY

Left: Male figure from Salamis, Cyprus, bearded in the Assyrian fashion. Right: Early Greek statue of Aphrodite who is bearing a dove in her left hand.

Photos: British Museum



LESSER TERN ALIGHTING AT NEST

Photo: E. J. Hocking

occur in any number. The Common Tern breeds along the south and west coasts, the Little Tern, the smallest of the British species, breeds along the south and east

Arctic Circle to the Antarctic Circle and back again.

Classification. Terns constitute the sub-family *Sterninae* of the family *Laridae*. Most of them belong to the genus *Sterna*.

TERPSICHORE, *terp sikh' o re*. One of the nine Muses, the patron of dancing, which she is said to have originated. She is represented as a laurel-crowned virgin, holding a musical instrument in her hand. See **MUSES**

TERRA-COTTA. An Italian term for a hard, durable, and attractive form of earthenware, made from clay of superior quality, and used in making architectural decorations, tiles, pottery, garden vases, flower-pots, monuments, fountains, chimney-pieces, and similar objects. It may be produced in almost any colour, but is frequently a warm shade of red or a rich cream colour. Often, in the manufacture of terra-cotta, clays from a number of different beds are secured. The material is weathered, ground, mixed with water and with sand, pulverized firebrick, or other vitrifying substance,

tempered, and then moulded into the desired forms. The pieces, after being partially dried, are worked over by the finisher, and are then baked in large kilns.

In spite of the comparative cheapness of

ornaments, statues and statuettes, tombs, potters' moulds, and numerous other objects, and it also had an important place in mural decorations in relief. In Italy, in the Middle Ages, there flourished a school of terra-cotta sculpture, founded by a member of the Della Robbia family.

TERRAPIN, *ter' ra pin*. See **TURTLE**.

TERRIER. The general name of at least fifteen kinds of dogs originally bred and trained to drive foxes from their holes, or to rout out and kill smaller animals, such as rats and mice. The name is taken from Latin *terra*, meaning "earth" and refers to their method of hunting. Such work demands strength, activity, grit, and a very durable coat. Terriers appear to be absolutely fearless, yet are particularly affectionate and faithful. There are separate articles on the different breeds.

TERRITORIAL ARMY. The only organized military force existing in the British Isles, excluding the Regular Army and its reserves. By the Territorial and Reserve Forces Act, 1907 (see **HALDANE**), the non-regular military bodies in Great Britain, including the Militia, Yeomanry, and Volunteers, were combined under one organization, at first known as the Territorial Force and later as the Territorial Army. The administration of the units and formations of the Territorial Army is carried out by the County Territorial Associations, under the supervision of the Parliamentary Under-Secretary of State for War, and the force is organized into divisions and mounted or infantry brigades with ancillary services, and comprises all arms. A recent amendment to the constitution of the Territorial Army allows of its employment overseas, but its members cannot be called out in aid of civil power. During a period of national emergency or on outbreak of war, the Territorial Army is called out, or *embodied*, as it is termed; and when embodied, called out for annual training in camp or on actual military service, it is

administered by the Army Council, and its officers and men are subject to the provisions of the Army Act and to Military Law.

Service in the Territorial Army is purely voluntary, the qualifying drills for efficiency must be done in the spare time of its officers



FIFTEENTH CENTURY TERRA-COTTA STATUARY

1. Boy with a shield and a bird. Florentine statuette (school of Desiderio) dating from the second half of the fifteenth century.
2. Two children quarrelling. Group by a follower of Donatello known as the "master of the unruly children." It dates from the second half of the fifteenth century.
3. Angels dancing. An Italian relief in terra-cotta.

Photos: Victoria and Albert Museum

this substance as a building material, and its durability, lightness, and resistance to heat, terra-cotta is not now generally used in architecture.

The Greeks and Romans employed it extensively in making roof tiles, gutters, house

and men, and the annual training of a week to fourteen days in camp comes out of the individual holidays of its members; grants, however, are made for all members reaching the standard of efficiency laid down for each arm or branch, and officers and men draw pay for periods spent at courses of instruction, when attached to Regular units, or when embodied. Small Regular Army staffs are provided for headquarters of formations and units, and Regular Warrant Officers and N.C.O.'s are attached to units as *Permanent Staff Instructors* for training. As the Territorial Army is raised upon a purely county basis, the closest liaison between Regular and Territorial county units is encouraged, and courses for Territorial Officers and N.C.O.'s or specialists are arranged at the dépôts of Regular units in the area.

Of recent years, the tendency has been to convert Yeomanry units into artillery and armoured cars and to increase the proportion of Air Defence units to other arms, thereby dividing the responsibility for defence of cities and areas in the British Isles between the Royal Air Force and Territorial Army, whilst the Regular Army provides air defence for the forces in the field.

TERTIARY, *ter'shū re*, **PERIOD**. The earlier of the two periods of the Cainozoic Age, succeeding the Cretaceous and succeeded by the Quaternary. The name, which means "third," is a survival of an early classification, in which the rocks now named Palaeozoic were called Primary, and those now named Mesozoic were called Secondary. The period is divided into four epochs—Eocene, Oligocene, Miocene, and Pliocene. Most of the existing genera and species of animals and plants originated during the Tertiary Period, although many of the characteristic forms of life of that time are now extinct.

TESTA. The outer coat of a seed. See GERMINATION.

TEST ACTS. The general name given to certain religious acts passed by the English Parliament, which were intended to prevent any but members of the Established Church from holding public office. Among the principal test acts were the Corporation Act of 1661, which decreed that all magistrates must take oaths of allegiance and supremacy, and must receive communion according to the Church of England; and the Test Act of 1672, which prescribed the same tests for the holders of public offices.

TESTAMENT, *old*; **NEW**. See BIBLE.

TESTATOR. See WILL.

TETANUS, *tel' a nus*. The medical term for lockjaw (which see).

TETRARCH, *tel' rark*. A Greek title antiently given to the governor of the fourth

part of a country. In the later Roman Empire, it was a title given to all native rulers below the rank of king.

TEUTON. A name applied to a Germanic people living near the Elbe in the fourth century B.C.; now used as a linguistic term applied to the Germanic branch of European languages, and synonymous with "Germanic." It is sometimes applied in a political sense to the inhabitants of Germany, but this use is inaccurate since these peoples are physically of mixed types.

TEWKESBURY. A Municipal Borough and market town of Gloucestershire, situated on the main road between Bristol and

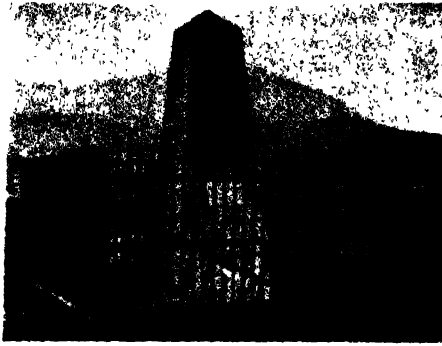


TEWKESBURY

A mill on the River Avon and (below) King John's Bridge.

Photos: Taylor

Birmingham at the confluence of the Warwickshire Avon with the Severn. It has an area of 2532 acres and a population of 4352 (1931). The town has been governed under Charters dating from the twelfth century, the last having been granted by William III on the 13th July, 1698. Its historic interest centres upon the abbey, which was consecrated in 1123 and which, on the dissolution of the monasteries, was purchased by the inhabitants from King Henry VIII to become the parish church. The central tower is one of the finest Norman towers in the country, whilst the Norman arch of the west front is magnificent. The panelled cloister is only fragmentary, but the east end is an excellent example of fourteenth-century architecture. The great battle of Tewkesbury in 1471 was fought in the meadows hard by the town, where the camp of Queen Margaret is marked by a dyke. Tewkesbury is the



BOUNDARY STONE

This marks the spot where Old Mexico, New Mexico and Texas meet.

Photo: P. & A.

Nortonbury of *John Halifax, Gentleman* and figures in the historical romances of *Malvern Chase* and *Hanley Castle*. The Borough's two silver-gilt maces of the seventeenth century are antiquities of rare interest. Modern industrial activity is represented by milling, building and glove-making.

TEWKESBURY, BATTLE OF. See EDWARD IV; ROSES, WARS OF THE.

TEXAS. A south-central state and the largest state in the American Union. It has an area of 265,896 sq. miles and a population (1930) of 5,824,715. The largest cities are Houston (292,352), Dallas (260,475), San Antonio (231,542), Fort Worth (163,447), and El Paso (102,421). The capital is Austin (53,120).

Formerly known as a vast cattle country, it is to-day first in crop values, first in cotton production, and second in exports among the states in mineral and forest products.

Physical Features; Resources. Several vast plains slope from the broken tableland in the north-west to the low, marshy shores of the Gulf of Mexico. The eastern and north-eastern part is an undulating timber-land, where there are dense forests of pine. The sandy soils, where cleared, are suitable for diversified farming and fruit-growing.

Westward from the timbered belt are the great Black and Grand prairies of the north-central section, constituting the finest agricultural regions in the state. Toward the west these prairies become broken and rise to meet the Great Plains, a vast, treeless tableland, rising in a series

of steppes from an elevation of 700 ft. to the high plains at the New Mexico boundary line.

There are several peaks over 8000 ft. in altitude, the highest, Guadalupe Peak, reaching 9000 ft.

The chief crop is cotton, which is most extensively grown in the coastal plain and central and northern prairies. The cultivation of rice has become an important industry along the coast, where the fields are flooded by water pumped from the lagoons and streams. Sugar, wheat and oats are also raised extensively. The number of cattle in the state is diminishing, but the sheep industry has doubled within recent years.

Mineral resources are relatively undeveloped. There are extensive fields of bituminous and lignite coal, and beds of a very pure iron ore. In the mountainous region are gold, silver, quicksilver, copper, and lead mines.

Oil was first discovered in 1866, and to-day the most important industry is oil-refining



IN SAN ANTONIO, TEXAS

In the foreground is the Alamo, where a handful of Americans withstood Mexican forces under Santa Anna during fighting for the independence of Texas. Behind is the modern Medical Arts Building.

Photo: U. & U.

TEXTILE PRINTING. Patterns on calicos and some other cloths are produced by printing. A copper roller on which the design is engraved is pressed tightly against a padded cast-iron cylinder and the cloth passed between the two. The colour is transferred from the engraved part of the roller to the cloth. If more than one colour is to be used there must be a separate roller for each. Sometimes, to give the appearance of a woven design, the cloth is printed on both sides.

Before the rotary press, cloth was printed by hand, the design being carved in relief on a wooden block. There was considerable difficulty in placing the block exactly in the right place on the cloth each time but, despite this, some very beautiful work was done by the printers of the eighteenth century. The stamps used were 10 in. long and 6 in. wide. It was the process of hand stamping that gave calico its name, for it was introduced into Europe from Calicut in India, where such stamping originated. The Chinese have known how to print on cloth with wood blocks from very early times.

TEXTILES. A piece of cloth, whether of silk, cotton, wool, or of linen, is an example of man's advance from the days of savagery to twentieth-century civilization. Modern clothing is composed very largely of textile materials, and among civilized peoples dress and fashion are of great importance, for clothing is one of the universal needs of civilized men and women.

All our important textile materials, such as cotton, wool, silk, and flax, had their beginnings in the remote past. No one can say definitely when these materials were first made, for the story of textiles is much older than recorded history, though there is one modern textile—artificial silk. It is easy to ask but difficult to answer the questions of how, when, and where did man learn to spin fibres into yarns, to weave, to dye and to print, and to create design.

Originally, the term "textile" meant a woven fabric, but to-day the word possesses a much wider connotation. Weaving is a very ancient art, whereas knitting is comparatively modern. Under the heading of textiles must be included knitted goods as well as woven fabrics, and such other goods as threads, twine, cords, felts, and lace. Even gold and silver threads, spun glass and asbestos are occasionally put to textile purposes. But the bulk of the raw materials of the textile industries is either vegetable or animal in origin. Roughly speaking, textile fibres may be divided into two classes: the comparatively short fibres, such as cotton, wool, waste silk, and flax, and the very long or continuous fibres, as in filament

rayon and reeled silk. The former are converted into yarns by a spinning operation, and the latter by a throwing process.

Yarn is the finished product of the spinner or of the throwster, and the raw material of the manufacturer who produces the woven or knitted fabrics. Thin chiffons, smooth satins, fine worsteds, figured brocades and tapestries, damasks, heavy sailcloths, and thick carpets are a few examples of the weaver's art. In knitted goods the range is almost as wide, and the fine-gauge silk stocking is one of the best achievements of the knitting industry. In certain kinds of textiles, particularly those used for industrial purposes, tensile strength and good resistance to friction are necessary attributes, whereas mere attractiveness is of little or no importance. But where durability is not an essential quality an attractive appearance becomes important. Most textiles, especially dress and furnishing fabrics, possess both a sound structure and a pleasing appearance.

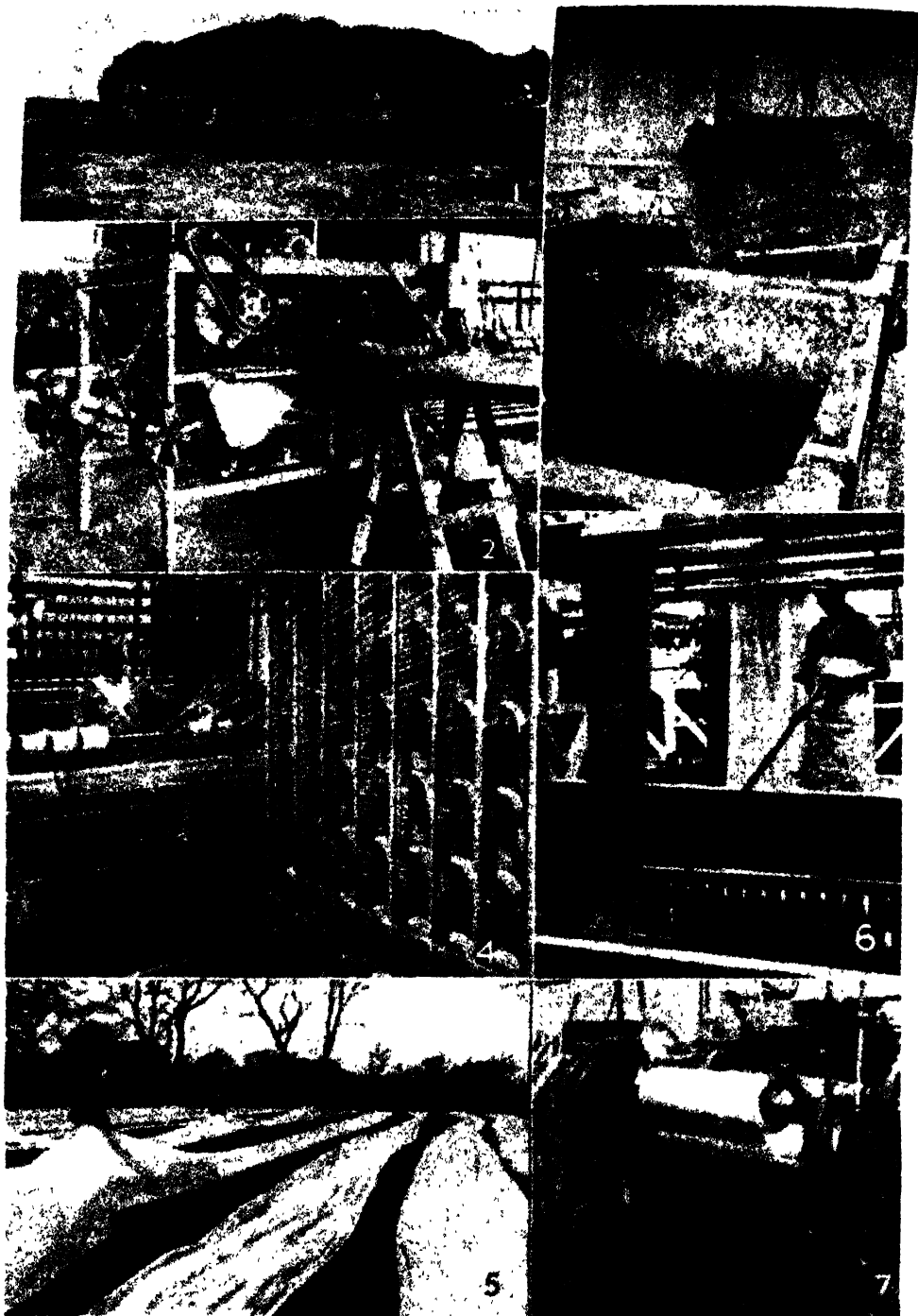
When textile fabrics leave the manufacturer's mill they are not usually ready for sale to the public. It may be necessary to subject the goods to one or more of a number of operations, such as bleaching, dyeing, printing, and finishing, before the cloth is suitable for its purpose. **SEE COTTON; FLAX; LINEN; RAYON; SILK; WOOL.**

THACKERAY, WILLIAM MAKEPEACE (1811–1863). One of the most celebrated English novelists of the Victorian Age. Thackeray was born on 18th July, 1811, in Calcutta, where his father was in the employ of the East India Company. He was sent, while still very young, to England to be educated. He spent several years at Charterhouse School, London, which he afterwards described in *The Newcomes*.

In 1832 Thackeray came into possession of a considerable fortune, which was soon lost by the failure of an Indian bank and by unfortunate investments. He went to Paris to study art; but he was soon convinced that he would never be successful enough at it to earn his living, which he now found himself obliged to do. He began, therefore, in 1837, to write humorous tales and sketches, which were contributed at first to *Fraser's Magazine*, and to *Punch* from its establishment in 1841 until 1851. Among the



W. M. THACKERAY
Photo: Brown Bros.



TEXTILE MANUFACTURE

1. Two bobby pullers on a twenty-two acre field of flax on the home farm of the Royal estate at Sandringham, Norfolk. 2. Flax de-seeding machine. 3. Flax packed in the retting tanks. 4. Warping machine at work. 5. Cloth spread on grass for bleaching. 6. Cloth being poled down into souring kiers. 7. Dye-jig.

Photos: Linen Research Association

collections of these writings are *The Yellow-plush Papers*, *The Irish Sketch-Book*, and the *Snob Papers*. In 1844 he published an outstanding work, the *Luck of Barry Lyndon*. With the appearance, in 1847-1848, of the serially published *Vanity Fair*, he became famous.

Vanity Fair was followed by *Pendennis*, which is in a measure autobiographical; *Henry Esmond*, a most faithful representation of English life in the early eighteenth century, and *The Newcomes*, which by its pathos proves once and for all that Thackeray was no cynic.

In 1851 Thackeray gave evidence of his keen insight into eighteenth century life in his lectures on *The English Humorists of the Eighteenth Century*, delivered in the United States. In 1855 he made a second tour, lecturing on *The Four Georges*. From 1859 to 1862 he was editor of the *Cornhill Magazine*, in which appeared his *Lovel the Widower*, *The Adventures of Philip*, *The Roundabout Papers* (a series of charming essays), and the first part of *Demis Duval*, which was left unfinished at the author's death. *The Virginians*, a sequel to *Henry Esmond*, published in 1857, is his only other really important novel.

THALER, *tah'ler*. A large silver coin current in North Germany from the sixteenth century until 1871, when the mark was first introduced. A few of these coins were still recently in circulation, being equal in value to three marks. The thaler was first coined in 1519 in the Bohemian town of Joachimsthal, from which it received the early name *Joachimsthaler*.

THALES, *thay'lees* (640-546 B.C.). One of the Seven Sages of Ancient Greece and the founder of the earliest school of Greek philosophers in his native city of Miletus in Asia Minor. He founded the geometry of lines, and was the first to apply that science to practical use in the measurement of the distance of ships at sea, the height of pyramids, etc. Much of his fame in his own day was the result of his accurate prediction of an eclipse of the sun in 609 B.C. The philosophy of Thales was based on the theory that all things are composed of or evolved from water; this was the origin of several later philosophies.

THALIA, *thū li'a*. One of the three Graces, and one of the Muses. See GRACES; MUSES.

THALLI, *thal' i*. See LICHENS.

THALLIUM, *thal'ium*. A metallic element resembling lead, discovered by means

of the spectroscope in 1861 by Sir William Crookes.

Thallium is found chiefly in crookesite, a mineral obtainable only in Sweden. There are traces of it in copper and iron pyrites. All compounds of thallium are poisonous. The chief uses of thallium are in connection with the making of optical glass, and in the manufacture of fireworks, to give a green colour. The atomic weight of thallium is 204.3, and its symbol is *Tl*.

THALLOPHYTES, *thal' o files*. See ALGAE.

THAMES, *RIVER*. England's most important, though not its largest, waterway. Roman writers mention the *Tamesis*, and the name is probably a Celtic word, meaning



ISLE OF THANET
Chalk cliffs at Birchington
Photo: Margate Publicity Committee

"broad river." It rises from springs near the village of Kemble, three miles south-west of Cirencester in Gloucestershire, and flows in a generally eastward trend for 209 miles, expanding below London into an estuary which widens to eighteen miles. The Thames is navigable for barges to within eighteen miles of its source, and it has been deepened below London Bridge until its docks are readily accessible to the largest vessels. The tributaries received include the Windrush, Evenlode, Cherwell, Ock, Thame, Pang, Kennet, Loddon, Coln, Wey, Mole, and, in the tide-way, the Wandle, Ravensbourne, Lea, Darent, Ingrebourne, and Medway. The Fleet river, now entirely underground, also enters the Thames. Including four navigation weirs above Oxford, there are forty-seven locks between Richmond and St. Johns. The river is controlled by the Thames Conservancy Board in the upper reaches and the Port of London Authority in the lower. See LONDON.

THAMES CONSERVANCY BOARD. See LONDON'S GOVERNMENT.

THANE or **THEGN.** This Anglo-Saxon title, meaning originally a servant, came to be applied to the *gesiths* or warrior companions of the kings, a class probably identical with the *comites* described by Tacitus in the *Germania*. Kings, victorious in the frequent wars of the early Saxon period, apportioned conquered lands to their thanes, until the rank came to be connected with land ownership, and the owner of five hides could claim thane-right. A thane might hold direct of the king or of an earl or a more powerful thane. He corresponds closely to the lesser baron or lord of the manor of the later Middle Ages. He owed military service to his lord, but on what conditions is not known.

THANET, ISLE OF. The extreme north-east corner of Kent. The sea coast was guarded by Roman strongholds at Richborough and Reculver. The area is now enclosed between two arms of the River Stour and the sea. It includes the holiday resorts of Westgate, Margate, Ramsgate and Broadstairs. See illustration on page 4213.

THATCHING. A method of making a roof with interwoven reeds or straw. The craft is very ancient and is still practised in country districts, particularly for the covering of

THEATRE (Gk. *theatron*, "a place for seeing"). A building where the public may witness dramatic representations. The early Greek theatre evolved from the choric dances to Dionysus, the god of wine and vegetation, and the dramatic contests at Athens were confined to the Greek festivals associated with this god. These annual ceremonials of homage never became an ordinary amusement of daily life, they were religious in intent, the Athenians having to rely on other forms of entertainment and recreation throughout the greater part of the year. The theatre was roofless, built usually on the slope of a hill near the city, and so large that the entire drama-loving population could be accommodated at a single performance. The famous "theatre of Dionysus," one of the first of the permanent theatres, was begun at Athens about 500 B.C., occupying a site on the south-east side of the Acropolis. A Greek theatre was divided into three parts, the auditorium, the orchestra, and the stage-buildings. The auditorium, or portion containing seats for the spectators, was usually built on a hill-side, the slope of the ground serving as a foundation for the tiers of seats. The lowest step of the auditorium was about 10 in. above orchestra level, rising towards the front row of seats until it reached a height of 14 in. The front row of seats was superior to the others, resembling a series of marble thrones. These were reserved for the priests, the high priests occupying the central throne.

In the Athenian theatre the seating capacity was approximately 17,000. It seems obvious that the Greeks had no pedantic ideas or feelings about the orchestra or "dancing circle." Probably, as at Epidauros, in ancient times the full circle was observed, but later it was encroached upon. As dramatic action developed, the "skene," or stage-buildings, where the actor changed his costume or his mask, lost its original meaning, until it was employed as a general term for the scene of action, or part thereof into which a play was divided.

Roman Theatres. The Roman theatres, unlike those of the Greeks, were built on level ground, a fact due to the Romans' engineering and architectural skill. Both in the theatres they erected and in the Greek theatres they remodelled, the orchestra was used, not as by the Greeks to house the chorus, but to accommodate senators and other notables. The first of the three stone theatres in Rome was built by Pompey (55 B.C.). Its seating capacity has been variously estimated at between 9000 and 40,000. The Roman theatres, it is assumed, were roofless, but the smaller theatre at Pompeii is believed to have had a permanent



THATCHING

The cottage, near Sandy, Bedfordshire, is 400 years old.

Photo Fox

stacks of wheat and hay and for roofing cottages and farm buildings. A thatched roof has heat insulation properties, helping to keep a dwelling cool in summer, warm in winter. The coming of the railways introduced some risk from sparks to thatched buildings closely adjacent to the lines, but decline in the craft really set in when roofing with slate and other tiles became much the cheaper process.

overhead cover. Evidence seems to point to arrangements having been made in the larger theatre for an awning that could, if needed, be stretched over the spectators' heads. Pliny speaks of a wooden theatre built by Caius Scribonius Curio in 50 B.C. This, according to the account, had twin auditoria, in which plays were presented to two separate audiences. After the morning performance the two theatres were swung together, forming a vast amphitheatre in which athletic contests were held. Remains of other theatres are at Pergamum, Magnesia, and Verulamium (St. Albans).

The English Theatre. England's plays during the Middle Ages were mainly religious in nature, and enacted in churches or in booths. (See **DRAMA**.) In the early sixteenth century secular drama was revived, and with its growing popularity came professional actors—strolling players, who performed wherever suitable accommodation offered. The drama now demanded a permanent home, and in 1576–7 James Burbage, one of the Earl of Leicester's players, built the first English theatre. Known simply as "The Theatre," this circular timber construction, said to have cost £600, stood in Holywood Lane, Shoreditch, until 1598, when it was demolished. From its materials Burbage built another theatre, the "Globe," with which Shakespeare's name will always be associated. Octagonal in shape, and composed of wooden uprights and lath-and-plaster walls, its site was the Bankside, Southwark. Also in Shoreditch, and contemporaneous with "The Theatre," stood another circular playhouse, the "Curtain." In 1592 and 1598 opened, respectively, the "Rose" and the "Swan," the first named likewise circular in shape. The "Blackfriars," near the old Dominican friary, London's first completely-roofed theatre, was opened by Burbage in 1596. Three years later the "Fortune" (which, rebuilt after a fire in 1621, stood until 1819 in Whitecross Street, St. Luke's, E.C.) was built for Edward Alleyn, the actor, and Henslowe, at a cost of £1320. From its building contract, still in existence, we learn that its shape was to be square. Walls of wood and plaster, a "tireynge-house" with glazed windows, and boxes ("gentlemen's roomes" and "twopennie roomes") are also mentioned.

The design of these early theatres owes much to the fact that hitherto performances had been given on a temporary platform in the middle of an inn courtyard. Around this stood the poorer patrons, the well-to-do occupying the galleries above. Similarly, in the first permanent theatres a central position was given the stage, on

three sides of which (the fourth being allocated to the "green-room") stood or sat the spectators, while encircling the stage were the galleries or boxes. On the Continent (where the plan of the buildings evolved from the ancient classic style) a theatre had been built in Paris (1548), in Rome (1580), and another in Vicenza (1584).

The Private Theatres. It was customary in the sixteenth century for amateur players occasionally to perform in certain theatres, adapted to their special needs. These theatres were called "private," since audiences were invited. Particularly famous was the "Blackfriars" under the Burbages. Others were the "Whitefriars" and the "Phoenix" (or "Cockpit"), opened in Drury Lane in 1616. Better equipped and



OPEN AIR THEATRE AT HEIDELBERG, GERMANY

considered more "respectable" than the public playhouses, the private theatres grew in popularity, though under professional management they ceased, save nominally, to be "private."

Scenic Art. After the reformation, certain technical devices, adopted generally in the English theatre (which, broadly speaking, then became the theatre as we now know it), owe their inception to the architect, Inigo Jones. In 1604 he brought back from Italy various ideas with which, in conjunction with Ben Jonson, he, as producer of the Court masques, was able to experiment. Among these were the (temporary) proscenium arch—forerunner of the curtain stage—the principle of perspective applied to scene-painting, and portable scenery.

Restoration Theatres. During the Civil War and until Charles II's return in 1660, the theatres were closed. But four years before their re-opening, Sir William Davenant's opera, *The Siege of Rhodes*, had been privately presented at Rutland House in Charterhouse Yard. The appearance in this play of Mrs. Coleman ended the tradition that debarred women from the stage, and marked the beginning of the new epoch that was to usher in actresses such as Nell Gwynn,



GREEK THEATRE AT EPIDAUROS

One of the best preserved of the ancient Greek theatres; the top row of seats is 103 ft. from the stage and 74 ft. above it

Photo DRON

Mrs. Betterton, Mrs. Barry, Mrs. Bracegirdle, and many others. The first Restoration playhouse was Sir William Davenant's "Duke's Theatre," Lincoln's Inn Fields, which, like Killigrew's "Theatre Royal," Drury Lane (opened 1663), was under Royal patronage. Other theatres followed, notably one in Goodman's Fields where, later, Garrick was to make his first stage appearance, and (in 1732) Covent Garden Theatre. Meanwhile, attendance at the drama had become almost exclusively a pastime of the Court, the public at large regarding the playhouses as centres of patrician corruption and holding aloof. Responding to the Court and Cavalier predilections, Dryden set himself to produce "heroic tragedies," which Killigrew and Davenant staged. Wycherley and Congreve later produced comedies of manners. Towards the early part of the eighteenth century, the salacious tone was ended by Jeremy Collier's famous diatribe against the *Profaneness and Immorality of the English Stage*.

Lighting. Seventeenth-century stage light-

ing was effected by chandeliers and lamps suspended over and at the side of the stage. Other lamps lined its forefront. Candles, set in iron hoops, were also employed for overhead lighting. In case of fire, quantities of water and large sponges on poles were available. Footlights and stripights are said to have been introduced at Drury Lane by Garrick in 1765. In 1817-18 the present Drury Lane theatre, built in 1812, was (with Astley's and Covent Garden) lighted with gas. In 1882 the Savoy Theatre was illuminated throughout with electricity. At present, with the advance in modern lighting equipment, floods, spots (controlled by rheostats or "dimmers") and other devices such as sky domes, by means of which diffused light is reflected upon the stage, are employed to heighten illusion.

The Stage. About the end of the eighteenth century, the apron-stage had virtually disappeared, and upholstered seats were replacing the benches in the pit, which, until stalls were introduced in 1883, occupied the entire auditorium ground floor. By 1900, the picture-frame stage had become normal

in the theatre. Boxes, too, although sometimes retained for ornamental purposes, had come to be regarded in the nature of an anachronism, not as coigns of vantage. Modern improvements include the revolving stage, the sinking stage, on which scenery is carried up from the basement; the wagon stage, comprising several platforms, one on top of the other, and each carrying a complete setting, which can be raised or lowered as required; and the sliding stage, which is on somewhat similar lines.

The Modern Theatre Abroad. Hungary

The Nemzeti Színház (National Theatre) remains the stronghold of dramatic art in Budapest, and the Shakespeare season the most profitable of its experiments. The majority of the theatres are ultra-modern. An open air theatre, a replica of the Regent's Park (London) design, is projected in Budapest, the site considered being on the slope of the Gelert Hill, overlooking the Danube. In Szeged, Eastern Hungary, an annual festival is held, the performances taking place in front of the church. Music is supplied by the church organ and from the roof of the Bishop's Palace. The play usually given is Madach's epic, "The Tragedy of Man."

Russia. The dominating feature of Russian dramatic art is the annual Soviet Theatre Festival (1st to 10th September),

which claims the distinction of being the only theatre in the world to reflect mass folk-art. It opens in Moscow and ends in Leningrad; in this city there are no new theatres of importance, but certain theatres have been remodelled and re-named—e.g. the Marinsky. Among Moscow's new theatres are the Meyerhold, Vakhtangov, the affiliated Maly Theatre, Zavadski, Simonov, and the Theatre of the Revolution. In Tiflis, Stalin's native city, is the Rustaveli, an outstanding example of the National (Georgian) Theatre, and able to compete on equal terms with any Moscow theatre. It gives performances during the Soviet Art Olympiad.

Germany. Modernism in the theatre is a feature of post-war Germany. In the newest playhouses, many of which have been designed by Professor Littmann, considered one of Europe's foremost theatre architects, unobstructed views of the stage from the auditorium and perfect acoustics have been secured through structural innovations.

France. Apart from attempts at modernism in one or two French theatres, such as the Théâtre du Vieux Colombier under M. Jacques Copeau, the Théâtre des Arts, and a few others, the stage has remained relatively conservative.

Italy. Luigi Pirandello's Teatro Odescalchi in Rome opened in 1925 to render outstanding plays by Italian and foreign



THEATRE OF DIONYSUS, ATHENS

Photo. OROC

authors. Marinetti, at Milan, has brought to the aid of the drama the latest devices of the lighting and scenic experts; and Scardaoni—on lines similar to those evolved by Gordon Craig in England—and Adolphe Appia have concentrated on the art of expression through the media of colour, light, and movement.

Repertory Theatres. Before the World War, repertory theatres had been established in Dublin (Abbey Theatre), Birmingham (Sir Barry Jackson), Bristol, Glasgow, Liverpool, Huddersfield, and Manchester. The last-named, opened under the auspices of Miss Horniman in 1907, has the distinction of being the first English Repertory. Among noteworthy post-war repertory theatres is the Maddermarket, Norwich, the home of the Norwich Players. Repertory in the United States includes the Henry Jewett Repertory Theatre, Boston; Eva Le Gallienne's Civic Repertory, New York City, and the New York City Theatre Guild.

Revue. Revue, which may be defined as a topical, often satirical potpourri of short sketches, songs, melodies, dances and spectacle, more or less connected, had been growing increasingly popular in Paris, as elsewhere on the Continent, since about the mid-nineteenth century. It was not, however, until the early twentieth century that London saw this form of entertainment, curtailed but more or less in its present guise. On 21st February, 1903, the late George Grossmith, Jr., produced *The Linkman* or *Gaiety Memories*, at the old Gaiety Theatre, following this at the Empire with a series of other short revues. Notable among these was *Everybody's Doing It* (Geo. Grossmith and C. H. Bovill) produced in 1912, and running for 354 performances. A few months later a more ambitious attempt was staged at the Alhambra by Grossmith and André Charlot. With the production at the Palace shortly before the War of *The Passing Show* (by Arthur Wimpers and P. L. Flers, music by Herman Finck), spectacular revue became firmly established in England. Since then innumerable revues, ranging from the intimate (and, from the production standpoint, relatively inexpensive type) to the lavish £30,000 affairs staged by C. B. Cochran and others, have made their appearance.

THEBES. An ancient Greek city in Boeotia, head of the confederacy known as the Boeotian League. Thebes lay in the south-eastern part of the country, about forty miles north of Athens and midway between Mount Helicon and the channel separating Boeotia and the island of Euboea. According to tradition, it was founded by Cadmus.

The authentic record of Theban history begins with a controversy between Thebes and Plataea toward the close of the sixth century B.C. In 431 B.C., a Theban force made an attack on Plataea by night, an event that precipitated the long-threatened Peloponnesian War. Under the rule of Sparta, the Boeotian League fell to pieces, but between 379 and 374 B.C. it was revived by the patriotic efforts of Pelopidas, and in 371 B.C. the Thebans under Epaminondas virtually wrested Grecian supremacy from the Spartans by the victory of Leuctra.

Theban supremacy did not long outlast the death of Epaminondas in 362 B.C., and the exhausted and disunited Greek states came under the rule of Philip of Macedon and his son, Alexander the Great. A revolt against Alexander was punished by the destruction of the city, but it was rebuilt in 315 B.C., and was revived under the later Roman Empire. Thebes again became prosperous during the eleventh and twelfth centuries as a centre of the silk trade, but it declined under the Turks. In 1311 it was destroyed by the Catalans, and the site is now occupied by Thivai, a small country town.

THEBES. See EGYPT

THEFT. See LARCENY

THEINE, *thē' in.* See CAFFEINE

THEMISTOCLES, *them' is' lō' kleez* (about 530-460 B.C.). An Athenian statesman and soldier, one of the most prominent of the Greek leaders during the wars with Persia. He attracted notice after the Battle of Marathon by his strong plea for naval expansion and by his opposition to Aristides. In 483 B.C. Aristides was banished, and Themistocles persuaded the Athenians to build ships and fortify their harbours, feeling certain that, in case of renewed invasion by the Persians, the conflict would be decided on the sea.

At the time of the Persian expedition in 480 B.C., he consented to serve under the nominal leadership of the Spartan Eurybiades, though the victory of Salamis was chiefly due to his efforts.

He did Athens good service by holding the Spartans in diplomatic parleys until the walls of Athens were practically rebuilt, contrary to the express demands of the Spartans. His arrogance, however, alienated the affections of the people, who began to credit rumours of treason, and some time before 471 B.C. he was ostracized. After remaining for a time in Argos, he fled to the Persian court, and was assigned by the king of Persia a residence in Magnesia, where he lived in luxury until his death. According to some accounts, Themistocles committed suicide by taking poison. The evidence for Themistocles's treasonable activity is incomplete.

THEOBROMINE. See ALKALOIDS.

THEOCRACY, (from Greek *theos*, god, and *kratos*, power). A form of government in which God is accepted as the Supreme Power, and the laws are received as the commandments of the Invisible Ruler. In such a government, the members of the priesthood act as interpreters and expounders of the laws, and have authority in both civil and religious matters. The most notable theocracy was that of the Israelites, to whom the law was given by God, through Moses, the Ten Commandments forming the basis of the covenant.

THEOCRITUS, *the oh' rit us*. A Greek poet, the first of the great pastoral or bucolic writers. He was born either at Syracuse or at Cos. The dates of his birth and death are not known, but he seems to have done his best literary work between 285 and 275 B.C. Thirty Idylls, or pastoral poems, bear his name, but it is highly probable that several of these were written by other poets. They consist of vivid descriptions of rural life, and are somewhat in the form of a simple drama, with groups of musical shepherds alternately responding.

THEODOLITE, *the od' o lite*. A surveying instrument for measuring angles. The movement of one circular plate, fixed to the telescope used in finding the object, is measured by verniers on another plate attached to the stand, in order to obtain horizontal angles. Perpendicular angles are measured on a third circle in which the telescope is hung. The modern machine used by engineers and surveyors is equipped with transits, and the instrument is properly called a theodolite-transit. See SURVEYING.

THEODORIC (about 454-526). King of the Ostrogoths, commonly known as **THEODORIC THE GREAT**. He was born in Pannonia, where his father, Theudemir, was joint ruler with his two brothers over the East Goths. In 474 his father died, he became chief ruler of the Ostrogoths and was alternately ally and enemy of the Eastern Empire. The Emperor Zeno feared him, and in 488 persuaded him to march against Odoacer in Italy. In 493 Ravenna, where Odoacer had taken refuge, surrendered and Theodoric's conquest of Italy was complete. The Eastern Emperors reluctantly acknowledged his kingship.

Under Theodoric Italy enjoyed a period of unexampled prosperity and peace. Taxes were lightened, agriculture was promoted, and the good will of the original inhabitants of the land sought in every possible way. Theodoric himself was a follower of Arianism, but he showed tolerance until near the close of his reign, when he imprisoned Pope John and permitted the execution of several

leading members of the Church, including the philosopher Boethius and Symmachus. Theodoric had sought to build a state in which Gothic valour would uphold Roman civilization.

In the later Middle Ages, Theodoric the Amal, like Arthur the Briton, became a hero of chivalric legend.

THEODOSIUS I, *the ô dô' sius* (about 346-395). Roman Emperor, known as **THE GREAT**. He was born in Spain and was the son of Theodosius, a great general who served the emperor Valentinian I. He accompanied his father in his campaigns in Britain, and himself defeated the Sarmatians in 374; but in 376, when his father was put to death, he retired from service and lived quietly in Spain. In 378 Emperor Gratianus summoned Theodosius to become his colleague on the throne, and gave him the Eastern provinces, including Thrace, Dacia, Macedonia, and Egypt. In 383 he granted large territories to the Goths, who in return provided him with an army of 40,000 of their warriors.

Theodosius was a Catholic and he suppressed both paganism and Arianism.

In 383 Gratianus met his death at the instigation of a usurper, Maximus, who seized Britain, Gaul, and Spain, and in 387 drove from Italy the young Valentinian II, brother of Gratianus. Theodosius, who had hitherto acknowledged Maximus, defeated and slew him and restored Valentinian as ruler of the West. A revolt in Thessalonica once roused his wrath, and he had 7000 or more of the citizens massacred by barbarian soldiers. As a punishment for this inhumanity, Ambrose, bishop of Milan, refused Theodosius communion for eight months, and brought him to repentance and public penance.

THEOLOGOGY. See RELIGION

THEOSOPHY, *the os' o fe*. A system of philosophic and religious thought, based on claims of a special insight into the divine nature and the fundamental laws of the universe. Jakob Boehme (1575-1624), a German mystic, claimed that he was enabled by a direct divine illumination to see the root of all mysteries. His conclusion was that the world is simply a manifestation of God, create! to exhibit, in the end, the eternal victory of good over evil, of love over wrath. Other thinkers along the same lines were Schelling, Molitor, and Swedenborg.

In recent years, the term theosophy has been widely accepted to represent the beliefs and teachings of the Theosophical Society. This society was founded in the United States in 1875 by Madame Blavatsky and several helpers. In 1907 Mrs. Annie Besant succeeded to the presidency of the society.

Hindu and Buddhist thought and doctrines have been prominent in recent theosophical teaching, a characteristic feature of which is the belief in reincarnation—that the spirit advances to its goal through a succession of earthly lives. The original home of Theosophy was India, and it has its beginnings in the early writings of the Brahmins, which contain its essential ideas. Similar ideas derived from the East are found in Neo-Platonism in the philosophy of Plotinus.

THERMAL SPRINGS, OR HOT SPRINGS.

Springs whose waters are warmer than the surrounding air. A thermal spring with water at the boiling point, which spouts into the air at varying intervals, is called a *geyser*. There are also quiet springs which have boiling waters. It is in volcanic regions that springs having the highest temperature are found, and in such cases the water is heated by coming in contact with hot rocks. Hot springs in non-volcanic regions are probably caused by the circulation of water, at great depths in the earth, before it returns to the surface under pressure. See *GEYSER*, *SPRING*.

THERMAL UNIT. See *CALORIE*; *UNIT*.

THERMIONIC VALVE. See *CINEMA*; *WIRELESS*.

THERMITE. A mixture of powdered aluminium and iron oxide, the combustion of which produces a temperature of 2600° ; it is used in welding, and also as a component of incendiary bombs.

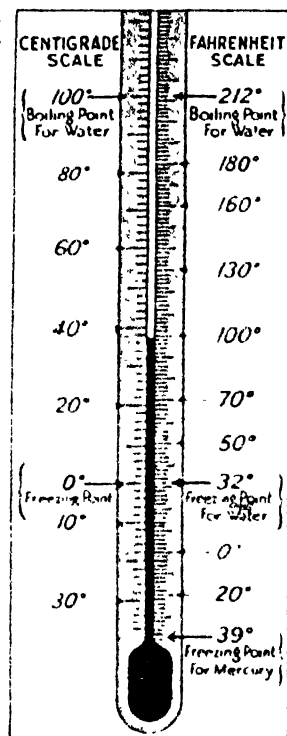
THERMODYNAMICS, *ther mo di nam' iks*. The science of the motive power of heat, or the application of the principles of mechanics to heat phenomena. See *HEAT*.

THERMOELECTRICITY, *ther mo el ek tris' its*. The electric current set up in a circuit of two or more unlike metals, or in a circuit of one metal the different sections of which are in unlike physical states, when one of the points of contact is heated or cooled. As electrical energy may be transformed into heat and light, so heat and light may be changed into electrical energy.

The thermoelectric pile, or battery, is constructed of alternate bars of antimony and bismuth soldered together, and is so sensitive to changes in temperature that it makes a very excellent substitute for a thermometer. As long as both faces have the same temperature, there is no current, but the slightest variation sets up a flow of electricity. This change may be almost infinitely small. There is, for example, enough heat in the body of a fly walking across one face of the pile to deflect the needle of the galvanometer. This peculiar action of metals of different heat-conducting powers in starting electric currents was first observed by Johann Seebeck (1770-1831) in 1822.

THERMOGRAPH, *ther' mo graf*. An instrument which automatically makes a record of changes of temperature. The thermograph has a spiral coil of metal which unwinds with a rise of temperature and winds up when cooled. These movements are recorded by a long needle carrying a pen, which traces a corresponding zigzag line on a revolving paper sheet moved by clockwork. Degrees of temperature are marked off on this sheet by vertical divisions, while hours of time are designated by horizontal distances. Usually, the paper is prepared to receive the record of one week.

THERMOMETER, *ther mom' e ter*. An instrument for indicating temperature, based on the law that bodies expand on heating and contract on cooling. The form in most common use consists of a glass tube, with a bulb of mercury or alcohol at the lower end. An increase in temperature causes the liquid to rise in the tube, and the point to which it rises is shown on a scale placed on or alongside the tube.



THERMOMETER
Showing gradings for both
Fahrenheit and Centigrade
scales.

There are three standard scales—the Fahrenheit, Centigrade, and Réaumur—but only the first two are in general use. The Fahrenheit (abbreviated F.) scale has 180 divisions, extending between 212° and 32° above zero. These limits are, respectively, the boiling and freezing points of water. This scale is in general use for weather temperature readings. A modification of this thermometer, called the *clinical thermometer*, has a very short column of mercury, and is used in taking body temperatures. On the Centigrade (C.) scale, the freezing point is marked 0° , and the boiling point 100° . This scale is

used generally in scientific calculations. The Réaumur scale has 0° for the freezing point and 80° for the boiling. Alcohol is used for recording very low temperatures, since mercury solidifies at -39° F.

The principle of the thermometer was known before the year 1600. It was Galileo who improvised the first instrument for measuring the range of temperature; this was an open-air thermoscope, which he displayed in 1593.

The term *thermoscope* remained in vogue until about 1625, when it was succeeded by *thermometer*. The first thermometer with a more accurate scale was probably an alcohol thermometer, made in 1641 by Ferdinand, Grand Duke of Tuscany. Twenty years later, this scale was improved by Fabri, the two pivotal points registering snow temperature and average midsummer heat. Between 1664 and 1694, the freezing and the boiling points of water were proposed as the fixed temperatures, but it was not until 1709 that Gabriel Daniel Fahrenheit with an alcohol thermometer, and in 1714 with one of mercury, introduced the scale with which we are now familiar. The Réaumur scale, taking its name from its inventor, was introduced in 1731; in 1742 Celsius and Christin devised the Centigrade scale.

THERMOPYLAE, *ther mop' il e*, meaning, literally, "the hot gates." The name of a mountain pass of Greece between Mount Oeta and the Maliac Gulf, leading from Thessaly into Locris. It had great strategic importance since it consisted of a single track about fifty feet wide which could be defended by only a few. Two battles famous in history took place here. In 480 B.C. Leonidas, king of Sparta, with 3500 soldiers defended the pass for two days against the whole invading force of the Persians.

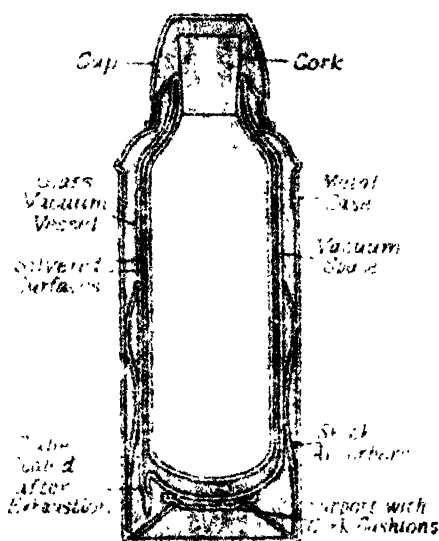
Two hundred years later (279 B.C.), another invader, Brennus the Gaul, was held at bay there for several days, until a way was discovered over the mountains.

THERMOS FLASK. A device for keeping substances either hot or cold. It is designed to minimize the flow of heat to or from the substance. Heat flows by conduction, convection and radiation.

The thermos flask consists usually of a double glass container enclosed in a metal case. The inner glass vessel is fused to the outer and the air between them is then exhausted. Convection of heat by air currents is thus prevented. Conduction can take place through the glass, but glass is a poor conductor. Radiation is reduced by silvering the glass, because a shiny surface radiates less than a black one.

The contents of the flask will reach the outside temperature in about 24 hours.

THERMOSTAT. An instrument used for the control of temperature. The source of the heat or cold is regulated automatically by the expansion and contraction of a temperature-sensitive material which is contained in the thermostat. Copper, mercury, or any solid or fluid which has a high coefficient of expansion may be used. When a change of temperature causes the material to expand or contract, the resulting movement is used to start a mechanical or electrical device which in turn opens or closes a valve or moves levers, thereby regulating



SECTIONAL VIEW OF THERMOS FLASK

the heat- or cold-producing apparatus. See HEATING AND VENTILATION.

THESEUM, *the' se um*. Among the Greeks, the name given to any temple erected in honour of Theseus (see below). A particularly celebrated one which existed in Athens in ancient times contained what was supposed to be the body of Theseus, and was ornamented with paintings and sculptures showing his deeds. It is doubtful, however, whether the famous and beautiful structure which is called the Theseum, is in fact the original temple of Theseus.

THESEUS, *the' se us*. A legendary king of Athens, whose exploits formed themes for Grecian poets, and whose rule established the original power of Athens. He was the son of Aegeus and Aethra, but was brought up in seclusion, and on attaining manhood he found his father under the influence of his wife Medea, who, when she saw Theseus,

recognized him as heir of the king and tried unsuccessfully to poison him.

Theseus killed the Minotaur with the aid of Ariadne, daughter of Minos, the king of Crete, to whom Athens had been paying human tribute. As a punishment for his



THESEUS'S SLAYING THE MINOTAUR

Photo: Anderson

crime in deserting Ariadne, on the return home Theseus was made to forget to change his vessel's sails from black to white, the agreed sign of the success of his expedition. In consequence his father killed himself when he sighted the black sail returning.

On his arrival at Athens, Theseus was proclaimed king, and gradually united the various Attic communities. After years of prosperous rule, during which he defeated the Amazons, who had invaded Greece, and married their queen, Hippolyta, he was driven by his people into exile on the island of Scyros, where he was killed. Later, public opinion changed and his remains were brought back to Athens and buried in a temple, the Theseum, where he was worshipped as a god.

THESPIA. A Greek poet, one of the earliest tragedians; his work is attributed to the sixth century. Thespis introduced in the old choruses an actor who replied to the leader of the chorus, thus laying a foundation for the spoken drama. He was himself both actor and manager, according to one authority—transporting his properties on a cart from place to place. From Thespis we derive the term *Thespian art* for the art of acting. See **DRAMA**; **GREEK LITERATURE**.

THESSALONIANS, EPISTLES TO THE. Two epistles written by Saint Paul from Corinth, in the year 51, to the Church in Thessalonica. They are the earliest letters of Saint Paul extant.

THES'SALY. A district in Northern Greece, in ancient times the largest of the historic divisions of that country. It is an extensive plain, enclosed on all sides by mountains that form an irregular square, each side of which is about sixty miles in extent. Mount Olympus, the fabled abode of the gods, rises on the north-east to a height of nearly 10,000 ft. Iolcus, on the Pagasæan Gulf, was the birthplace of the Jason of legend, and the harbour from which the Argonauts set sail.

In the fourth century B.C., the Thessalians united under an historic Jason, tyrant of Pheræ, and seriously threatened the rest of Greece, being checked only by the assassination of their leader. Thessaly passed under the control of Macedonia in 352 B.C. through the conquest of Philip of Macedon, and was subject to that country until the Roman Flaminus, by the victory of Cynoscephalæ in 197 B.C., made Macedonia a dependency of Rome. It remained a Roman province until the fall of the Eastern Empire, after which it was dominated successively by the Venetians and the Turks. During the Greek war for liberation, which ended in 1827, the southern part was freed from Turkish rule, and the greater part of the region was united with Greece in 1881, through the intervention of the Great Powers.

At the present time, Thessaly comprises the nomes, or departments, of Phthiotis,



Larissa, Karditsa, Trikkala, and Magnesia. The great majority of the inhabitants are Greeks.

THETFORD. See **NORFOLK**.

THETIS. Mother of Achilles. See **ACHILLES**.

THIERS, *tyair*, LOUIS ADOLPHE (1797–1877). French statesman, historian, and President of the Republic. He was born in Marseilles and educated for the law; but, finding a literary and journalistic career much more to his liking, in 1818 he went to Paris to write for the *Constitutionnel*. He also devoted much time to writing a *History of the French Revolution* in ten volumes.

Under Louis Philippe, Thiers became a member of the Chamber of Deputies, and between 1832 and 1836 held various offices in the Ministry. He resigned in 1836 when Foreign Minister, but in 1840 again became President of the Council and Foreign Minister, only to be driven from office by the King's disapproval of his policy of favouring



LOUIS ADOLPHE THIERS
Photo - Brown Bros

him, and had him banished in 1851, but permitted him to return the next year. He re-entered political life in 1863.

Though he opposed the Franco-German war, throughout it he laboured zealously to gain aid for his country from the other European powers, and later became "chief of the executive power" in the provisional government, and brought about peace with Germany. With great vigour he put down the revolt of the Commune in Paris, and in August, 1871, for his services he was declared President of the Republic for three years. In 1873 he resigned.

THIGH. The upper part of the lower limb, between the hip-joint and the knee. The thigh contains one bone, the *femur*, which is the greatest bone in the body, and is in length exactly one-quarter of the total length of the body. It also contains the greatest nerve in the body, viz the *sciatic nerve*, other nerves, blood-vessels, and the muscles which bring about movements of the hip and knee joints.

THIRD DEGREE. A method involving the infliction of pain, physical or mental, to extract confessions or statements about a crime. Its many forms include physical brutality and abuse, intimidation or threats, protracted questioning accompanied by the

denial of food and sleep, refusal to allow access of counsel to the prisoner, and illegal detention.

THIRD-PARTY INSURANCE. See **MOTOR CAR** (Organization of Motoring), **MOTOR INSURANCE**.

THIRD REPUBLIC. See **FRANCE**.

THIRST. The sensation by which the body makes known its need of water. It is one of the *general*, or *internal*, sensations, as distinguished from the *special* or *exterior* (see **SENSATION**), and is thus in the same group as hunger, pain, and fatigue. The first sensations of thirst are experienced in mouth and throat, which feel dry. Moistening these parts without any actual ingestion of water will cause a disappearance of the sensation, while a local drying of these parts, even if the body itself be supplied with water, will produce the sensation. The pharynx, then, is the seat of the end-organ for the sensation of thirst, and it is here that the sensation is first recognized as satisfied. That the end-organ is sensitive to the general condition of the entire body is evidenced by the fact that the sensation of thirst may be appeased, in extreme need, by the injecting of fluids into the tissue or veins; also, in extreme loss of moisture, no amount of local moistening will cause thirst to disappear.

THIRTY-NINE ARTICLES. The statement of the religious belief of the members of the Church of England (which see). They are based on forty-two articles drawn up in 1551 by a commission. Edward VI died immediately after their publication, and Queen Mary would not acknowledge the Articles; but under Elizabeth, Archbishop Parker revised them, reducing them to thirty-nine. They were finally settled by canon and confirmed by the queen in 1571, and were ratified anew in 1604. The Thirty-Nine Articles are accepted by the Episcopal Churches of Scotland, Ireland, and America, the latter having adopted them, with a few slight changes, in 1801.

In their origin, the Articles of Religion were devised as a compromise between the views of the advanced reformers and those who were more Catholic-minded, and were intended to make it possible for both groups to remain loyally within the Church. They have accordingly always received widely varying interpretations.

THIRTY TYRANTS. A body of rulers representing the aristocratic party at Athens, appointed by the Spartans when they gained supremacy after the Peloponnesian War. Under the brilliant but unscrupulous Critias, they plotted to establish their rule permanently, installing at Athens a Spartan military governor and garrison. They disarmed all the citizens except their own adherents, and

put to death many wealthy members of the opposing party. In 403 B.C., after about a year of this reign of terror, the old democracy was restored.

THIRTY YEARS WAR, THE. This great religious war was really a series of conflicts covering the period between 1618 and 1648.

The underlying cause of the war was the old, deep-seated hostility between the German Protestants and Roman Catholics, intensified by the different ways in which they interpreted the Treaty of Augsburg (1555), especially with reference to Church property. Both parties had violated the treaty at will; also the Hapsburgs of Austria were seeking for the Empire the practical domination of Germany which they had long held in theory.

The Outbreak in Bohemia (1618-1623). In 1608 the Protestants began to get ready for the inevitable clash by organizing the Evangelical Union. The Catholics retaliated with the Holy League. The King Elect, Ferdinand of Styria, supported the Catholics. It was an old Bohemian custom for the people to punish offending officials by throwing them out of a window, and this treatment the mob applied to two of his ministers. This Defenestration of Prague precipitated the civil war. (*Defenestration* is from *fenestra*, the Latin for "window.")

At first the Protestants met with success. They drove out the Jesuits and elected Frederick, the Calvinist Elector Palatine, as their king, but the Lutheran princes withheld support. Ferdinand II had recently succeeded Mathias as Emperor and Bohemian king, and the army of the League won for him an overwhelming victory at the Battle of the White Mountain. When insurrection was stamped out, the Bohemian Protestants were deprived of their special religious privileges.

The Danish Period (1625-1629). The King of Denmark, Christian IV, who took the first step against the Emperor, enlisted the aid of one or two other states, and helped by a subsidy from England, he opposed Ferdinand's forces in Saxony. But the emperor had received unexpected assistance from Wallenstein, Duke of Friedland. This army, and the forces of the Holy League under the great general Tilly, defeated the Danish king time after time, and he finally withdrew, after signing the Peace of Lübeck (1629). Even before that, the Emperor had issued the Edict of Restitution, in accordance with which all possessions of the Catholic Church acquired by the Protestants after the Peace of Augsburg were to be returned.

The Swedish Period (1630-1635). The "Lion of the North," Gustavus Adolphus,

hero-king of Sweden, now entered the combat. He had two motives for interfering: his sincere devotion to Protestantism and his ambition for Sweden, whose position on the Baltic would be endangered if the Emperor succeeded in his plans. In 1630, therefore, Gustavus Adolphus sailed with 16,000 men—the best trained and best-disciplined army in all Europe. The Swedish army defeated Tilly's forces at the Battle of Breitenfeld (1631), and the following year in another conflict, in which Tilly was killed.

Emperor Ferdinand was now forced to recall Wallenstein, previously dismissed. At the Battle of Lutzen (1632), Wallenstein's army was driven from the field, but Gustavus Adolphus met his death. The Swedish army rapidly sank to the general level, and in 1634 was badly beaten at Nordlingen. At about this time, the Emperor, seeing cause to suspect Wallenstein of treason, had him assassinated.

Swedish-French Period (1635-1648). Cardinal Richelieu, the real ruler of France, determined to interfere on behalf of the German Protestants, as a means of blocking the growth of Hapsburg power. He had assisted Gustavus Adolphus with influence and supplies, and in 1635 he declared war on Spain, the Empire's ally. Under the brilliant leadership of Turenne and Condé, as well as of the Swedish generals Torstensson and Wrangel, a long series of victories was achieved. Mazarin continued his policy, and in 1643 Condé broke the famous Spanish infantry at Rocroi.

The Peace of Westphalia (1648). The people had long been crying for peace and relief from the misery this dreadful war brought upon them. In 1645 the European powers sent representatives to a peace conference, the Catholic and Protestant delegates meeting separately in two different cities of Westphalia. Tedious negotiations resulted in 1648 in the Peace of Westphalia. The struggle had had little effect on the religious situation, the North remaining Protestant, the South Catholic. The Empire, however, had been practically killed. Ferdinand III, who had succeeded in 1637, had to acknowledge formally the independence of Holland and Switzerland.

Effects of the War. Pitiable indeed was the condition of Germany at the close of the war. More than half the population had been killed, and the survivors saw nothing but ruin wherever they looked. Whole cities, villages, and farms had disappeared. Art, science, commerce, and industry were dead. Thirty years of fighting had brought a lowering of moral standards from which Germany suffered for several generations.

THISBE, *this' be*. See PYRAMUS AND THISBE.

THISTLE. Familiar name applied to a widely distributed group of plants bearing sharp spines or prickles. They are members of the composite family and are mostly weeds. Thistle plants have tough, fibrous stems, much-divided, prickly leaves, and soft, silky flowers of various colours, usually borne in round heads that form large, downy seed balls after the blossoms wither. The



THISTLE
Photo: Visual Education Service

seeds are scattered by the winds, and thistles therefore multiply rapidly.

It is supposed that the plant adopted by the Scots as their national emblem is the species known as *cotton thistle*, so called because it has a covering of white down.

Scientific Names. The term thistle is strictly applied to the species of *Carduus*, *Cirsium*, or *Oncus* of the family *Compositae*. The Scots thistle is *Cirsium aculeis* or *Onopordon acanthium*.

THISTLE, ORDER OF THE. A royal order of Great Britain, conferred only upon peers of Scotland. Founded in 1687, it consists of the King and members of the Royal family and sixteen knights. Its motto is *Nemo me impune lacessit*.

THOMAS, RIGHT HON. JAMES HENRY (born 1874). Cabinet Minister in Labour and National governments. Born at Newport, Monmouthshire, of poor parents, he

had little schooling, and became an errand boy at the age of nine. Later he was employed on the Great Western Railway as engine cleaner and driver. He was from the first a zealous Trade Union worker in Swindon, and his experience of Trade Union committee work led him to local and national politics. In 1910 he became President of the Amalgamated Society of Railway Servants and entered Parliament as Labour Member for Derby, a constituency which remained faithful to him until his final retirement. From 1918 to 1931 he was General Secretary of the National Union of Railwaymen.

When the first Labour Government took office in 1924, Mr. Thomas was appointed Secretary of State for the Colonies. In the second Labour Government of 1929-31 he was Lord Privy Seal and Minister of Employment. The economic crisis of 1931 was a turning-point in his career, for he broke with most of his former political associates and joined the coalition National Government. In the new administration he was Secretary of State for the Dominions (1931-6).

He resigned his ministerial office and his seat in Parliament in the summer of 1936, in consequence of the association of his name with an inquiry into the leakage of Budget secrets.

THOMAS A BECKET. See BECKET, THOMAS A.

THOMAS A KEMPIS (about 1380-1471). A medieval religious writer, author of *Imitation of Christ*. He was born at Kempen, in the Lower Rhine district, of a peasant family whose name was Hammerken. He acquired a good education in a famous school at Deventer, and about the year 1400 entered the Augustinian monastery of Mount St. Agnes, near Zwolle. In 1413 he was ordained a priest, and thereafter lived in quiet at Mount St. Agnes, becoming sub-prior in 1425.

He wrote *Meditations on Christ's Life*, *The Soul's Soliloquy*, and *Garden of Roses*, as well as the *Imitation of Christ*, which, though generally credited to A Kempis, has been the subject of a long controversy, since no definite proof exists of its authorship.

THOMAS, SAINT. See APOSTLES.

THOMPSON, FRANCIS (1850-1907). An English poet, the son of a Lancashire doctor. He was educated at Ushaw College. Like



J. H. THOMAS
Photo: Photopress

Keats, he studied medicine, but abandoned that profession when his absorbing interest in writing led him to London. There, after five years of hardship and privation, his poems attracted the interest of Wilfrid and Alice Meynell (see MEYNELL, ALICE). With their help, he published, in 1893, his first volume of poems, which included the famous "Hound of Heaven." He later published *Sister Songs* (1895), *New Poems* (1897), and a prose treatise, *Health and Holiness* (1905), on the ascetic life. Tuberculosis, caused by years of hardship, brought about his death.

THOMSON, JAMES (1700-1748). Thomson, a poet of Scottish parentage, is best

known as the author of "The Seasons" (1730) and of "The Castle of Indolence" (1748). He wrote "The Seasons" in blank verse, and shows a remarkably sure control over an instrument which was unfamiliar in an age dominated by the couplet. His detailed and sympathetic descriptions of Nature are remarkable as a new departure for a poet in the eighteenth century. He also wrote plays.



JAMES THOMSON
(Aged 25)

Photo: Brown Bros.

Thomson is perhaps best known as the writer of the famous verses beginning "Rule, Britannia."

THOR. In Northern mythology, the god of thunder, and eldest son of Odin. He was the strongest of the gods, and their champion in the almost incessant wars against the giants. As a child, Thor was noted for his great strength. When he had grown to maturity, he built in Asgard a palace which he named Bilskirnir (lightning). Thor was especially the god of peasants and the labouring classes. In the 540 halls of his great palace, he met his favourite dead warriors who had fallen in battle, and feasted with them, as Odin did with their masters.

Thor's wife was Sif, whose golden hair was stolen by Lok. To appease the wrath of Thor, Lok had a magic hammer made for him by the dwarfs. This hammer was red hot and returned inevitably to the hand which threw it. Thor also possessed a magic girdle which doubled his strength whenever he drew it around his body.

As Thor rode about the heavens in his brazen chariot drawn by two goats, from

whose teeth and hoofs sparks were constantly flying, the lightnings flashed from his hammer, and as he threw it through the air, the thunder roared. Thursday is Thor's day.

THORACIC, *thor as' ik*, DUCT. Term for the main collecting trunk of the lymphatic system. It is the great trunk which receives the lymph from all of the body below the diaphragm, and from the left half of the body above the diaphragm. This duct, or canal, which is about the size of a goose quill and from 15 in. to 18 in. long, begins below at about the level of the second lumbar vertebra, in a dilated portion called the *receptaculum chyli*, or "receptacle of the chyle," and extends up along the front of the vertebral column to the seventh vertebra of the neck; there it curves forward and downward, opening into the junction of the left jugular and left subclavian veins. Lymphatics from the right half of the body above the diaphragm open into the right subclavian vein.

THORAX. The upper part of the trunk in the human body. It is separated from the abdomen below by a dome-shaped muscular partition, the diaphragm. Its contents, the heart, lungs, and greater blood-vessels, are protected by a bony casing composed of the ribs, the breast-bone and the twelve thoracic vertebrae.

THORIUM. A heavy metallic element, the dioxide of which, called *thoria*, is used in the manufacture of incandescent gas mantles. The element, which was discovered in 1828 by a Swedish chemist, is a grey powder which burns with a bright flame when heated in air, it occurs in monazite, orangite, thorite, and similar minerals. Thorium has a wide distribution, though it occurs nowhere abundantly. Brazil, Norway, and the United States are important sources of supply. Thorium is a radioactive element (see RADIOACTIVITY). Its chemical symbol is *Th*.

THORN. In botany, a short, hard, sharp-pointed, and leafless branch, as of the hawthorn, it develops from a bud, like tree branches. The term is also applied to any thorn-bearing shrub or small tree, especially to the hawthorn and the blackthorn.

THORWALDSEN, BERTEL (1770-1844) Danish sculptor, the son of a wood-carver. He began his studies at the age of 11 at the Academy of Copenhagen and later went to Rome, where he received encouragement from Canova. He quickly acquired a reputation, and was employed on a number of important commissions.

Thorwaldsen was one of the leaders of the classic revival of the period, but the reputation that he then possessed has not survived the passage of time. His best-known work is the "Lion of Lucerne," a

memorial to the Swiss Guards who died in the defence of the Tuileries in Paris; it was copied by the Swiss sculptor, Ahorn, and chiselled out of solid rock at Lucerne.

His other works include: "Entry of Alexander the Great into Babylon" and a monument to "Pius VII," both in Rome; "Christ and the Twelve Apostles" in Copenhagen; and "Cupid and Psyche," "Jason with the Golden Fleece," and the medallions "Night" and "Morning."

THOTH, *thóth*. Egyptian god of wisdom and patron of art, science, and letters. He was represented with the head of an ibis, and with a scribe's pen and palette in his hands. The records of the judgment of departed souls in the hall of Osiris were kept by him.

THOTHMES III, *thoth' meez* (called THE GREAT). A king of ancient Egypt, under whom the country came to the zenith of imperial expansion. Through a series of sixteen campaigns, he subjugated Syria and Palestine, and organized them together with Nubia as the Empire of Egypt. On the walls of the great temple of Amon at Karnak he had the annals of his campaigns inscribed, including an account of the Battle of Megiddo, the first battle in history of which full details are recorded. He built many temples and erected the obelisks known as Cleopatra's Needles,



THOTHMES III

Statue in the Cairo Museum
Photo: OROC

one of which stands now on the Thames Embankment and the other in New York. He succeeded to the throne about 1501 B.C., and died about 1447 B.C. His mummy, like those of Seti I and Rameses II, was discovered in 1881 at Deir-el-Bahri.

THOUGHT. In its broadest sense, thought denotes any activity of the mind, thus standing in somewhat the same relation to the mind as *motion* bears to the body. The word is, however, generally used rather more narrowly, so as to exclude from its meaning those activities of the mind which are more properly classed as sensations and emotions. In this sense, thought is limited to those faculties which the mind can exercise without immediate dependence upon the body, i.e.

reason and imagination. See LOGIC; PSYCHOLOGY.

THRACE, *thrays*. The ancient name of an extensive region in the Balkan Peninsula, situated to the north of Macedonia, with rich agricultural lands and great mineral wealth. At one time the territory called Thrace extended from Macedonia to the Danube, and eastward as far as the Black Sea; while under the Romans, Thrace was the region south of the Balkan Range.

The Thracians were of Indo-European origin, akin to the Phrygians of Asia Minor. After having been made nominally dependent on Persia, the Thracians were subdued by Macedonia about 350 B.C. They regained



their independence for a short time on the fall of Macedonia, but were conquered by the Romans, and Thrace became a Roman province about A.D. 72. Its most important towns were Abdera, the birthplace of Democritus; Sestos, on the Hellespont, celebrated in the story of Hero and Leander; and Byzantium. In 1453, the entire region fell under Turkish control.

In 1878, after the Russo-Turkish War, the northern part of Thrace was separated as Eastern Rumelia. The Conference of London, 1913, gave this territory to Bulgaria at the close of the Balkan Wars, but in 1923 the Powers awarded Western Thrace to Greece and the remainder to Turkey.

THREAD. The terms "yarn" and "thread" are commonly used as if they were synonyms, and in everyday language the words are interchangeable. Technically, however, there is a difference. Yarn is the long strand of twisted fibres as it leaves the spinning machine. But the yarn of the spinner is not suitable for every purpose, and special treatment is frequently necessary. When yarn has received this further treat-

ment it becomes a thread. For example, when two or more yarns are twisted together for reasons of strength, smoothness, roundness, etc., a thread is produced. Sewing thread is usually made from six single yarns, which are twisted together, made smooth by singeing, and finally polished. Similarly, threads are manufactured for crocheting, knitting, and lace. Embroidery threads are made from cotton, which is frequently mercerised, from flax, rayon, and silk. Lisle thread is a smooth hard-twisted folded cotton yarn and largely employed in the manufacture of hose and half-hose. Fancy or effect threads, such as grandrille, spot, snarl, flake, slub, etc., are used in the production of special or novelty effects. In the manufacture of ladies' silk hose a number of yarns, say, 6, 8, 10, or 12, are put together and used as one thread; the hose is thus described as 6-thread hose, 10-thread hose, etc. See COTTON; SPINNING.

THREADWORM. See PARASITE AND PARASITIC DISEASES.

THRESHER. A species of shark notable for the long slender tail and a habit of using this long flail-like appendage as a means of herding herrings and other fish, on which it feeds, into masses which are more easily attacked than scattered fish would be. This harmless shark is common in Atlantic and Mediterranean waters and is often taken by fishermen in the English Channel and Irish Sea. It reaches a length of about 16 ft., but 6 ft. or 7 ft. specimens are commonest.

Scientific Name. *Alopius vulpes*

THRESHER. An agricultural machine which actually consists of a combination of four machines: the thresher itself, which threshes the kernels of grain from the straw; the separator, which separates the grain, together with considerable chaff, from the straw; the winnowing machine, which cleans the grain; and the stacker, which discharges the threshed straw on to a stack.

The threshing part of the machine consists of an iron cylinder called the *beater*, to which vertical teeth are attached in rows, and a *concave*, which is a section of a similar cylinder with the teeth on its inner surface. These are so adjusted that the teeth of the cylinder pass very close between the teeth of the concave and, as the grain passes through between these teeth, the kernels are rubbed out. At the back of the cylinder is the grate, which consists of a series of parallel steel bars spaced about an inch apart, against which the threshed straw and grain are forcefully thrown. Most of the grain falls through the slots between these steel bars to the grain conveyer below, while the straw passes over the grate on the straw

rack, which has a vibratory or shaking motion that shakes out the remaining grain. The straw rack finally discharges the straw into a fan, which blows it out on to the stack.

The grain conveyer carries the grain to the winnowing machinery, where it is separated from the chaff by a blast of air.

THRIFT. See SEA-LAVENDER; SEA-PINK.

THROAT OR PHARYNX. The space which lies behind the nose, the mouth, and the voice-box or *larynx*. There are two openings into it from the back of the nose, through which the air passes when we breathe with the mouth closed. At a lower level is the opening from the mouth, through which the food passes. Below, the throat is continued downward as the gullet, or *oesophagus*. On either side, just behind the openings from the nose, is a small opening, that of the *Eustachian tube*, which passes backward and outward to the cavity of the middle ear, so that the air in the latter can be maintained at the same pressure as that of the outer atmosphere. See LARYNX; PHARYNX; TRACHEA; also QUINSY, etc.

THROMBOSIS. See APOPLEXY.

THROTTLE. See PETROL ENGINES.

THROWING THE HAMMER. See HAMMER, THROWING THE.

THRUSH. One of a group of song birds found in all parts of the world. The numerous species include various plain brown birds,



SONG THRUSH AT NEST

Photo. John Kearson

with whitish and usually spotted breasts. Thrushes are migratory. They inhabit wooded regions, spending much time on the ground and feeding largely upon insects, thus proving themselves of value to man. They are the highest order of songsters. In Britain there are two fairly common thrushes, the Mistle-thrush and Song-thrush, and a very rare visitor, the Rock-thrush. The two former are placed in the same genus along with the Fieldfare, Redwing, Ring-necked Blackbird, and the latter is in a genus closely related to the Redstart.

The Missel-thrush, whose name is derived from the bird's fondness for mistletoe berries, is larger than the Song-thrush, or Throstle, is grey on the back, and in flight the outer tail-feathers are conspicuously white, whereas the upper parts of the song-thrush are warm brown in colour. Both these birds are commonly distributed throughout Britain and are familiar to most people. The song-thrush is often known locally as the Mavis.

In the autumn both these birds move southward, those from the north to warmer districts in Britain, while others go to southern Europe.

The Rock-thrush breeds in southern Europe. It is smaller in size and of a general bluish-grey colour.

Scientific Names. The thrushes belong to the family *Turdidae*. The missel-thrush is *Turdus viscivorus*; the song-thrush *T. musicus*; the rock-thrush, *Monticola saxatilis*.

THRUSH. An affection of the mouth, technically known as *parasitic stomatitis*, most commonly seen in weakly infants. It is brought about by lack of cleanliness, especially of feeding bottles, and consists in the growth of a certain yeast-like fungus over the mucous membrane of the tongue, mouth, and throat. It is treated in normal cases with alkaline sprays or mouth-washes, e.g. of glycerine and borax.

THUCYDIDES, *thū sid' id eez*. A Greek historian of the fifth century B.C. His masterpiece, *A History of the Peloponnesian War*, has been divided into eight books. The narrative covers twenty-one of the twenty-eight years of the war, the period from 431 to the middle of 411 B.C.



THUCYDIDES
Photo. Anderson

Thucydides was born in Attica of a wealthy family. During the Peloponnesian War, in 424 B.C., he was in command of part of the Athenian fleet, but his failure to relieve the siege of Amphipolis made him an exile for twenty years. He returned to Athens in 403 B.C., shortly after the close of the war, and probably died two or three years later. His importance in literature lies in the fact that he is the first historian to use the analytical method, to seek motives rather than actions, and to show the proper relation between cause and effect.

THUGS, THE. This Indian fraternity lived by robbery and murder, carried out according to ancient religious rites and in honour of the goddess Durga or Kali, the Destroyer. They encountered, by seeming accident, unsuspecting travellers, whom they strangled with remarkable dexterity, using a twisted kerchief or scarf, and subsequently buried. These practices were suppressed by Lord William Bentinck, Governor-General of India, who in 1830 put Major William Sleeman in charge of a special anti-Thug department. The word has been adopted in common speech for one who robs with violence.

THULE, *thu' le*, or, more commonly, **ULTIMA THULE**. The name usually given in ancient literature to the most northern of habitable or known lands.

THULIUM. See **CHEMISTRY** (Elements).

THUNDERSTORMS. These occur when a warm, moisture-laden and ascending lower layer of air is covered by a drier layer with a greater temperature gradient. The ascending saturated layer comes into contact with the cooler dry air, and heavy clouds are formed and rain generally results. The ascending air current is generally caused by intense heating of the earth's surface, and hence thunderstorms are most frequent in warm climates, or in temperate regions in the hottest period of summer days. A thunderstorm may also occur in connection with a line squall when warm wet air is undercut by a current of cold air. Electrical discharges depend on the larger raindrops being positively charged and the finer water particles being negatively charged. Most of the electrical discharges pass between the clouds; discharges between the clouds and the earth are less frequent. See **LIGHTNING**.

THURINGIA. A division of Central Germany, with an area of 4541 sq. miles and a population of 1,659,510 (1933). Much is mountainous and heavily forested, but the north is low-lying, fertile, and agricultural. Famous cities include Jena (pop. 58,357), noted for optical instruments and its ancient university, Gotha (pop. 47,843); and Weimar (pop. 49,327), associated with Goethe and Schiller. The seven Thuringian States united in 1919, but their constitution was abolished in 1935, when a governor, appointed by the Chancellor, was given absolute power.

THURSDAY. The fifth day of the week, literally *Thor's day*, sacred to the ancient Scandinavian god of thunder. See **THOR**.

THURSO. See **CAITHNESS**.

THUYA. See **ARBOR VITAE**.

THYME, *tīm*. A fragrant garden herb belonging to the same family as mint, and cultivated in gardens as a flavouring. Its scent is due to an oil contained in the leaves and

stems, from which is prepared the drug thymol, used as a remedy for intestinal troubles and for hookworm disease. The plant grows from 6 in. to 10 in. high, and has square, hairy stems, narrow leaves, and small lilac or purplish flowers, borne in separate whorls.

Scientific Names. These plants belong to the family *Menihaceae* (or *Labiatae*). Garden thyme is *Thymus vulgaris*; wild thyme is *T. serpyllum*.

THYMUS, thi' mus. A structure situated in the front of the neck in infants. It is at its largest at the age of two years, after which it slowly dwindles, until it has almost disappeared at the age of puberty. Little is known of its functions; recent investigation suggests that it is a ductless gland, producing a hormone which has to do with the development of the mind and the growth of the body in infancy. See HORMONES.

THYROID, thi' roid. See ENDOCRINE GLANDS; GLANDS; GOITRE.

THYROID CARTILAGE. See LARYNX.

TIAN'-SHAN MOUNTAINS. A mountain system of Central Asia, commencing in Russian Turkistan and extending nearly 1500 miles in an easterly direction to the Desert of Gobi. The highest peak is Khan-Tengri, rising 24,000 ft. above sea level. The mountains contain vast mineral wealth, almost entirely undeveloped.

TIBERIAS, ti be' rias, SEA OF. See GALILEE.

TIBERIUS, ti be' rius, CLAUDIUS NERO CAESAR (42 B.C.-A.D. 37). The second Roman emperor, the son of Tiberius Claudius Nero, an officer under Julius Caesar, and Livia, who was afterwards the wife of Augustus. His mother used her powerful

paigms in Germany and Gaul. Tiberius was compelled by Augustus to divorce his wife, Vipsania Agrippina, and to marry Julia, the emperor's daughter. After the death of his grandsons Caius and Lucius Caesar, being left without heirs, Augustus adopted Tiberius and designated him as his successor.

Tiberius at first governed well. Throughout his reign, all the provinces of the empire were especially prosperous. In Rome, however, he showed a growing suspicion of possible rivals and increasing cruelty. Postumus Agrippa, grandson of Augustus, his former wife Julia, the daughter of Augustus, Tiberius' own son, Drusus Caesar—all were put to death. His own death at Misanum, at the hands of Macro, was the final act of violence of the reign.

Tiberius was a man of undoubted ability, clear of judgment, tenacious of purpose. Contemporary accounts of his character are probably biased against the emperor.

TIBER, River. The river on which stands the city of Rome. A sediment of sand and mud deposited at the mouth of the river has built up the land until, at the present time, the harbour is considerably farther out than in the days of ancient Rome.

The Tiber is the second largest river of Italy. It rises in Tuscany in the Apennines, 4160 ft. above sea level, and after a winding course of 253 miles, empties into the Tyrrhenian Sea (an arm of the Mediterranean), about twenty-six miles below Rome. It enters the sea by two branches, one of which is a channel excavated by the Emperors Claudius and Trajan. Under normal conditions, the river is navigable for small steamers as far as Rome.



TIBERIUS
Photo - Anderson



AN ISLAND ON THE TIBER IN THE CITY OF ROME
Photo - Visual Education Service

influence to secure the advancement of Tiberius and his younger brother Drusus, and the former won considerable distinction in the army, carrying on successful cam-



YAKS IN AN INN COURTYARD IN TIBET

The natives use the hair, flesh, milk and hides of these animals, as well as employing them for transport.

Photo: OROC

TIBETI, *tib es' le*. A mountain range in the French Eastern Sahara. It is inhabited by Tibbus, who raise some livestock.

TIBET, *tib et'*, OR **THIBET**. A country of Central Asia which has long been nominally

three millions. The inhabitants call their country Bod, or Bhöt.

On the south lie the lofty Himalayas and other ranges, and on the north and northwest the Kuen-lun range, ascending to a height of 20,000 ft. Enclosed thus on three sides by towering peaks, the tablelands of Tibet have an average elevation of fully 16,000 ft. The Brahmaputra River, in Tibet called the Tsang-po, flows over a thousand miles eastward, to find its Indian outlet to the sea. The Indus also rises in Tibet.

The People. The very small population is explained in large measure by the poor rainfall, high elevation, and infertile conditions.

The people are of Mongoloid stock and have been little influenced by Western ideas. In religion, the Tibetans profess Lamaism, an offshoot of the Buddhist faith. Raising large families and increasing the number of households is a serious matter, because of the difficulty of making a living, so thousands of young men become monks and lead a celibate life in monasteries. The monks are called *lamas*.

Among the people polyandry exists. The average number of husbands is three.

The Capital. The only city of importance is LHASA, which is also the holy city of the Tibetans; it is known as "the Forbidden City," because its sacred temples have always been guarded zealously from white people. Lhasa proper is a closely packed assemblage of stone and brick dwellings and shops, interspersed with many temples.



TIBETAN FAMILY

Photo: Visual Education Service

a part of China, but which in reality possesses an almost independent government. The area is 750,000 sq. miles and the population is now estimated at not more than

About fifteen monasteries are scattered through the suburbs and over the plains. The curiously constructed houses have low, flat roofs and no chimneys; paper, oiled or plain, serves for windows. At night, light is furnished by torches or primitive lamps fed with vegetable oil. Besides being a great centre of the Buddhist faith, Lhasa is important in trade and commerce, being the terminus for caravans to and from India, Kashmir, Burma, China, Mongolia, and Turkistan. Tea, silks, carpets, rice, and tobacco are the chief articles of commerce. The resident population, not including the garrison and the monks, is about 15,000, although this number is greatly increased by a floating population of pilgrims and traders, making the total from 40,000 to 80,000.

Resources. It is possible to live but a few months of the year in the high altitudes, where sheep and yaks, buffaloes and pigs are pastured during the warmer weather. In the valleys, barley, vegetables, and fruits

are grown. There is some mining of gold, borax, and salt. Weaving and wool-spinning are the only industries.

During the nineteenth century, Europeans were practically prohibited from entering the country, and were speedily expelled if found within it. Some explorers, however, succeeded in visiting some districts. Since the World War, British representatives from India have been welcomed in Lhasa.

Government and History. Because of its inaccessibility, Tibet is difficult to govern effectively from Nanking, especially in view of the opposition of the people to China. The civil and religious authority is the *Dalai Lama*, or *Grand Lama*, who rules from Lhasa. For years the Chinese government worked

steadily to bring Tibet under control of China, but Chinese authority is felt only slightly in the country; indeed, Tibet has practically maintained independence since 1912. Although the Dalai Lama and his ministers were forced to flee to India in 1910, the Tibetans were successful in 1912 in keeping the Chinese troops out of Tibet. In 1913 the Chinese attempted to negotiate with the Tibetan government. The Tibetans

demanding that a British representative be present at the conference. The agreement drawn up was refused by China, but hostilities were suspended, pending renewal of the negotiations.

Fighting was renewed in 1917, and the Tibetans succeeded in capturing territory as far east as the Yangtze River. In 1918 a truce was signed, and Tibet retained the territory gained. Through 1919, 1920, and 1926, the Chinese government's proposals for renewal of negotiations were unsuccessful. In 1922 Tibet installed a telegraph system

uniting Lhasa with the Indian system.

TIB'IA OR SHIN BONE. A very stout bone which, with the slender fibula, forms the skeleton of the leg from the knee to the ankle. Its upper end forms the floor of the knee-joint (see *KNEE*) and its lower end is attached to the *astragalus* to form the ankle-joint (see *FOOT*). The shaft of the bone is roughly triangular in section, one side lying immediately beneath the skin for the greater part of its length. The inner ankle bone is a prolongation of the tibia, thus often becomes broken in the common injury known as *Pott's fracture*.

TIBULLUS, ALBIUS. A Roman poet (c. 54–c. 18 B.C.). Very little is known of his life. He enjoyed the patronage of Messalla,



TIBETAN GIRL IN HOLIDAY ATTIRE

A length of sheep's wool, with the skin, is woven into the hair at each side of her head. The ornaments on the back of the leather headdress are turquoise and are her savings.

Photo: ORIX.



PALACE OF THE DALAI LAMA IN LHASA

one of Augustus' leading generals, and seems to have been a general favourite with his contemporaries. His poems, which are all in the elegiac metre, are mostly love-poems, many of them are of considerable beauty, though more for their elegance of style than for any great depth of feeling displayed in them.

TICAL, *te kahl'* A standard coin in Siam.

TIC DOULOUREUX, *tik du lu rez'* A French term meaning "painful twitching," the name of an acute form of facial neuralgia. There are usually shooting pains on one side of the face, which last only a few moments, but recur frequently. Facial neuralgia often originates in diseased teeth or tonsils, or is due to an infected area elsewhere in the body. Another possible cause is pressure on a nerve, producing pain by reflex action. The application of heat is sometimes successful in relieving the pain.

TICHBORNE FAMILY. A house of ancient lineage which has held large estates in Hampshire since Saxon times. The baronetcy was created by James I in 1623 in favour of Henry Tichborne, who was appointed commissioner of plantations in Londonderry and afterwards Governor of Drogheda. He fought in the Civil War on the Royalist side. His descendant, Sir Henry Tichborne, the seventh baronet, had four sons. Of these the first three succeeded in turn to the title and estates. The third, James, who became tenth baronet in 1853, married a lady belonging to a noble French family. Their elder son and heir,

Roger, was lost at sea in 1854, and the baronetcy then passed to his younger brother Alfred.

Tichborne Lawsuit. Lady Tichborne, widow of Sir James, refused to believe that her son Roger was dead, and in 1865 advertised for news of him. One Thomas Casho, a butcher of Wagga Wagga, in New South Wales, who was afterwards identified as Arthur Orton of Wapping, made claim to be the missing heir, and the prosecution of his suit gave rise to the celebrated Tichborne lawsuit which was before the courts from 1867 to 1872. The suit was rejected. Thereupon the claimant was tried on a criminal charge of perjury and sentenced in 1874 to penal servitude.

TICK. An oval-shaped parasitic animal belonging to the same class as mites, spiders, and scorpions (see ARACHNIDA). Ticks are chiefly injurious because they often carry in their bodies certain disease germs which they transmit to the blood of their victims.

Ticks and mites are much alike in body structure. Most of the forms called ticks may be seen without a glass, even in the larval stage. Many of the mites are microscopic. Ticks live only on blood. The bodies of these arachnids are seemingly all in one piece, though in some species a groove is found between the abdomen and fore part of the body. Ticks have a movable process at the anterior end that serves as a head. The blood of their victims is drawn through a beak equipped with strong recurved teeth that enable the parasites to cling to their hosts most tenaciously.

The males and females mate on the bodies of the animal hosts; the female is larger and requires more food. After a good meal ticks can live for an extraordinary length of time before they require another.

If a tick is removed roughly from the skin its rostrum is almost certain to be left attached and to cause delay in the healing of the wound. Tick bites are liable to bleed for some time as ticks exude a substance which stops the natural coagulation of the blood.

Certain parasitic insects belonging to the order Diptera are occasionally found on sheep and birds and are often mistaken for ticks. But there should be no difficulty in identification as ticks are wingless, have four pairs of legs in the adult stage, and the body is at the most in two recognizable sections. Insects proper are usually in three parts and have three pairs of legs.

TIDES. The periodic rise and fall of ocean waters, observed on most sea coasts twice a day. The reason for the phenomenon was discovered when Sir Isaac Newton furnished the key to the solution with his theory of gravitation. According to this principle, every particle of matter in the universe during every instant of time is attracting every other particle. Tides are caused by the attractive force of the sun and moon, as it is exerted on the earth. That is, these bodies pull upon the earth in such a way as to cause a piling up of the water envelope; the effect on the solid earth is, of course, not discernible, for the land envelope acts as a rigid body and does not perceptibly yield to the pulling force.

The course of the daily tide is as follows. There is a gradual rise for about six hours, and then the water remains stationary for a short time. Then it begins to recede, and continues to fall for the succeeding six hours. The highest stage is called *high tide*, and the lowest *low tide*. The landward movement is called *flood tide*, and the receding one, *ebb tide*. On every portion of a coast, there are two high and two low tides within a little more than a solar day, the average interval between two successive high tides being about twelve hours twenty-five minutes. The hours of high and low tides vary from day to day; they occur at the same hour only once in each lunar month.

According to Newton's laws of gravitation, the sun exerts a greater attractive force on the earth than the moon, because of its immense size (see GRAVITATION). But, as the moon is only 240,000 miles away while the sun is 93,000,000 miles, it has a greater tide-producing effect than the sun.

When the sun and moon are pulling in a

straight line the effect of the sun's attraction is added to that of the moon's and the resulting high tide is higher than normal, and the resulting low tide lower than usual. Such tides, which advance and retreat farther than usual on the shore, are known as *spring tides*. On the other hand, when the sun and moon are pulling at right angles to one another, the low tide due to the sun is at the same place as the high tide due to the moon; and therefore the resulting high tide is lower than usual. Similarly, the low tide is not so low as usual, because the solar high tide is at the same place as the lunar low tide. Such moderately high and low tides are known as *neap tides*.

TIENTSIN, *te en' tseen'*. A Chinese city in the province of Chi-li, first opened to foreign trade and settlement by a treaty negotiated in 1860, and now, next to Shanghai, the most important seaport. Estimated population, 1,388,747.

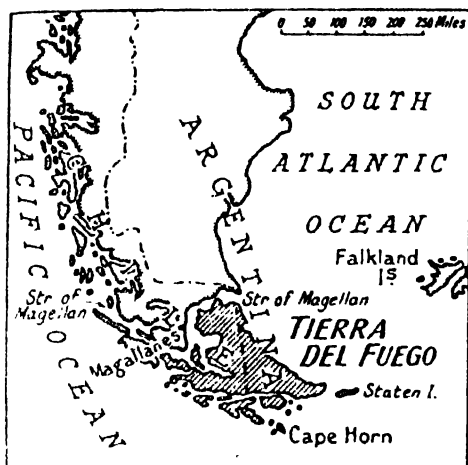
Exports include straw braid, furs, hides, camels' wool, tobacco, wood, and coal; the imports are chiefly woollen goods, jeans, sugar, rice, grain, petroleum, tea, opium, paper, steel, and salt.

TIEPOLO, *tyeh' po lo*, GIOVANNI (1692-1769). Italian artist; born in Venice, he studied under Gregorio Lazzarini and Battista Piazzetta, quickly becoming well known as a fresco painter in his native town, where he decorated many churches and private houses. In 1750 he went to Würzburg to paint the ceilings and frescoes in the Archbishop's Palace and, eleven years later, to Madrid, where he decorated the Royal Palace at the command of Charles III. He died in Madrid in 1769.

The greatest artistic influence in Tiepolo's life was Paul Veronese, and his paintings echo, in a minor key, the dash and spirit of the master's work. His smaller sketches, such as, for instance, "The Wooden Horse being brought into Troy," at the National Gallery, are much admired to-day.

TIERRA DEL FUEGO, *tyé' ra del fueh'* go. An island group lying off the southern extremity of South America, from which it is separated by the Strait of Magellan on which is the world's southernmost city, Magallanes (until 1920 Punta Arenas), with a population of 29,500. The archipelago was discovered in 1520 by Magellan. These islands have a total area of about 28,000 sq. miles, but over four-fifths of this territory is included in the area of one large island, sometimes known as King Charles South Land, but more generally as East Tierra del Fuego. The archipelago is divided politically into two sections, one the possession of Argentina and the other of Chile. The Argentine portion, 8500 sq. miles,

consists of the eastern part of the main island and Isla de los Estados, or Staten Island, an isolated island on the extreme east. The western part of the large island and the rest



of the archipelago, 10,500 sq. miles, belong to the Chilean Territory of Magallanes. The population is small, mainly Indians with a few sheep farms of Chilean and British settlers.

TIFLIS. See GEORGIA (U.S.S.R.).

TIGER. A lithe, beautifully marked jungle cat of Asia. For strength and fierceness, it has only one rival, the lion.

In size, in the structure of the skeleton, in number of teeth, and in claws, the lion and the tiger are much alike, but there the



TIGER
Photo Topical

resemblance ceases. The tiger has no mane, and it cannot roar. Its coat is not full fawn, but is bright fawn in colour, shading to white underneath, and beautifully marked with irregular strips of black. The largest tigers are found in India; those in Southern Siberia, Turkistan, Persia, China, and Japan, and those on the islands of Java and Sumatra, are smaller. The Indian tiger is

sometimes as much as 10 ft. long from the tip of the nose to the tip of the tail, and its coat is very glossy and brilliant; the tigers of colder regions have a thicker, rougher fur.

Habits. The tiger is a carnivorous (flesh-eating) animal. In India its principal food consists of deer, wild pigs, antelope, young buffalo, and cattle. The terrible "man-eaters" are sometimes old tigers whose first vigour has departed, and whose teeth are so worn that they find men even easier to kill than domesticated cattle.

Because tigers have their lairs in the jungle, where the grass and undergrowth are very high and dense, they cannot be successfully hunted on foot. Natives are sent out on foot to "beat" the bush and drive the tigers out of their hiding places into the open, where they are shot by hunters mounted on elephants. This is a somewhat dangerous sport, as the tiger may spring to attack.

The tiger's average length of life is twenty-five years.

Scientific Name. The tiger belongs to the family *Felidae*. The species found in India is *Felis tigris*. Other forms are usually regarded as varieties or sub-species.

TIGER LILY. A tall garden plant, native to Eastern Asia. It was so named because its reddish-orange blossoms, splashed with black, suggest the colour and markings of the tiger. The plant is produced from bulbs (which are used for food in China and Japan) and is a favourite in gardens.

Scientific Name. The tiger lily belongs to the family *Liliaceae*. Its botanical name is *Lilium tigrinum*.

TIGLATH-PILESER, *phl*

e' zer. The name of several Assyrian kings mentioned in the Old Testament.

Tiglath-Pileser I, whose reign began about 1120 B.C. He made conquests in Northern Syria, Cappadocia, Persia, Armenia, and Kurdistan, and even entered the city of Babylon. The next king of the same name ruled about 950 to 930 B.C.

Tiglath-Pileser III, the most important of the name, ruled from 745 to 727 B.C. His original name was Pulu, or Pul. He established



TIGER LILY

Assyrian colonies in hostile territories, thinking that a more profitable scheme for gaining control than the ordinary methods of invasion by force. Frequent revolts in Northern Syria occupied much of his time. In 728 B.C. he was crowned king of Babylonia, but died the following year, leaving the empire to his son, Shalmaneser IV.

TIGRIS, RIVER. A river of Iraq, which rises in Kurdistan, not far from the Euphrates, and has a course of about 1100 miles before joining that river at Qurnah,



BOATBUILDING IN MESOPOTAMIA

Basket-boats, called *kufas*, are used on the River Tigris to transport passengers, animals and freight across or down stream. They are not paddled up stream.

Photo C. & C.

90 miles from the Persian Gulf. Most of its course is over the plains, where it is important for irrigation. It is navigable for small vessels to Baghdad and even to Mosul. Other important towns on its banks are Diyarbakir and ancient Nineveh. Its delta is named the Shatt-el-Arab. See IRAQ.

TILES. Flat, curved, or tubular pieces of baked clay, glazed or unglazed, used for covering roofs, floors, and walls, as furnace linings, and in the construction of drainage pipes. The processes of manufacture are much the same as those employed for bricks. Coarse, rough clay is generally used in making the tiles for drainage pipes, and the pieces are tubular or semi-tubular. A continuous pipe is made by the overlapping of

separate tiles, each of which has an extension at one end, for the purpose of fitting closely to its neighbour. Wall tiles are made of fine grades of clay, of terra-cotta, and sometimes of porcelain.

Encaustic is the trade name for decorative tiles used in such a way that there is a main ground of one colour and an inserted pattern of contrasting colour. Small, unglazed tiles in plain colours, combined to form a design, are called *mosaics*.

Wall tiles were first made in Syria, the Tigris-Euphrates Valley, and Persia.

TILLY, JOHANN TZERCLAES, COUNT OF (1559-1632) A German general who, between 1574 and 1604, held commands in the Spanish and Austrian armies, including a Spanish provincial governorship from 1590 to 1594.

In 1604 Tilly became general of artillery, in 1605 field-marshal, and in 1610 was selected by Maximilian, Duke of Bavaria, to reorganize the forces of the Catholic League, which he later commanded in the Thirty Years War (which see).

TILSIT, PEACE OF. See NAPOLEON I.

TIMBER. See LUMBER.

TIMBUKTU. A town of French West Africa, situated near the southern boundary of the Sahara Desert, nine miles north of Kabara, its port on the River Niger. The site was settled in the eleventh century by the Tuaregs. Timbuktu is the trading centre for merchandise brought from the north of Africa and the regions south and west of the Niger. The items of exchange include gums, rubber, gold, salt, wax, ivory, hardware, cheap fabrics, and beads.

The population is about 5700, but in the trading months, from March to June, it reaches 25,000. See SAHARA.

TIME. According to the common conception, any section of time is a period of duration which extends between two events. For convenience, we divide such duration into periods of specified length, and call them years, months, days, hours, minutes, and seconds.

We base the length of these periods, or time units, on certain astronomical events. The astronomer records the time between two successive positions of a star across a given meridian; such duration is a *sidereal* day. This unit is the exact time it takes the earth to turn on its axis, but is about four minutes less than twenty-four hours. During the period of a sidereal day, the earth moves on a certain distance in its orbit around the sun, and consequently for the same place to face the sun again, it has to make just a trifle more than one rotation on its axis. The small bit of time needed for this extra movement gives us our day of

twenty-four hours (nearly). Therefore we call the time from one midnight to the next, or from one noon to the next, a *solar* day.

It is always noon in any particular place when the sun is on the meridian of that place. As the earth rotates from west to east, when it is noon at Greenwich it is not yet noon at Bristol and it is past noon at Dover, for the sun is not yet on the Bristol meridian and has already passed the meridian of Dover.

If every town were to use the true noon as found by the sun at that place, there would be endless confusion. Consequently, by agreement, Greenwich noon is used everywhere in Britain. Over bigger areas



VULG. CALENDAR STONE

such an arrangement would not be satisfactory, so Europe has been divided into zones 15 degrees wide in which the same time is kept. For instance, Central Europe is one hour ahead of Greenwich and Eastern Europe two hours ahead.

In America there are five times, each differing from the next by one hour.

Division of Time: Calendar. This is a systematic division and record of time.

The Egyptians divided the year into twelve months of thirty days each, and added five days at the end of the year. The year was thus too short by nearly six hours. The Greek year included twelve months of thirty and twenty-nine days, alternately. This arrangement gave a year of only 354 days, $11\frac{1}{2}$ days short of a solar year. To make up this difference an extra month was added in alternate years, except that every eight or nine years the extra month was omitted.

The earliest known system among the

Romans was a year of ten lunar months, four of which had 31 days, the remainder only 30. This year of 304 days was too short by about one-sixth. Each year thus began two months earlier in the season than the last. About 700 B.C. January was added to the beginning and February to the end of the year. This made a year of 354 days. Every second year a month of 22 or 23 days had to be added to compensate for the $11\frac{1}{2}$ days lost. About 450 B.C., the months were rearranged in their present order, but March was regarded as the beginning of the year. Owing to the addition of a day for "luck," the calendar year was then $366\frac{1}{4}$ days long.

In 46 B.C. Caesar decreed the reform of the calendar. The year was divided into twelve months of 31 and 30 days alternately, except February with 29 days. February was to have 30 days every fourth year. The seasons were readjusted to the calendar by making the year 16 B.C. fifteen months long, from 13th October to the second following 31st December. The new year then began on 1st January. Later there were minor adjustments.

The *Julian calendar* provided a year of $365\frac{1}{4}$ days, or 11 minutes 14 seconds longer than the true solar year. This difference led to a gradual change in the calendar date of the equinox, until about 1580 it fell on 11th March, ten days earlier than it should have occurred. In 1582 Pope Gregory XIII determined to correct this discrepancy by dropping ten days from October. By this arrangement, the day that would have been 5th October, 1582, in the Julian calendar became 15th October. To correct a discrepancy in the Julian calendar the *Gregorian calendar* omits the additional day in February in century years not divisible by 400. The difference between the civil calendar and the astronomical year now averages only 25.95 seconds. Germany retained the old style until 1700, and England did not change until 1752.

From *perpetual calendars*, such as may be consulted in an almanac, the day of the week may be found for any date A.D.

Ecclesiastical Calendar. The Church calendar is regulated partly by the sun's position and partly by the moon's phases. Such days as Christmas, the Feast of the Circumcision, and the Nativity of the Blessed Virgin are *fixed days*, originally set according to the solar calendar. Such days as Easter, however, are known as *movable feasts*, their date being determined by the moon's periods.

Hebrew Calendar. Hebrew chronology begins with the Creation, which is supposed to have taken place 3760 years and 3 months before the beginning of the Christian Era.

The Hebrew year ordinarily consists

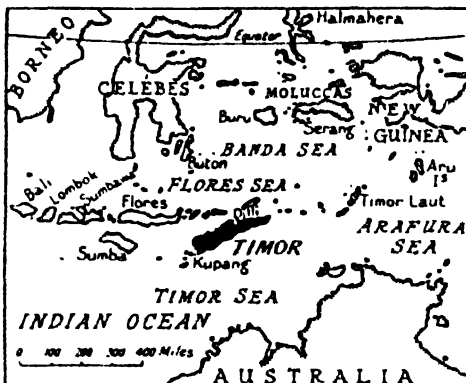
of twelve lunar months: Tishri, Heshvan, Kislev, Tebet, Shebat, Adar, Nisan, Iyar, Sivan, Tamuz, Ab, and Elul. These months are alternately 30 and 29 days long. At seven intervals during each nineteen years, an extra or *embolismic* month of 29 days, called Veadar, is inserted between Adar and Nisan, and Adar is given 30 days instead of 29.

Mohammedan Calendar. The Mohammedans reckon time from the Hegira, which occurred in A.D. 622. The Mohammedan year consists of twelve lunar months, or 354 days. As the calendar year is much shorter than the solar year, the Mohammedan new year constantly retrocedes through the seasons. In the course of thirty-two and one-half years, the Mohammedan new year completes its backward course through the seasons. The Mohammedan calendar also divides the years into cycles of thirty years each. Of each cycle, nineteen are regular years of 354 days, and eleven years have an extra day. The Mohammedan calendar has an error of one day in about 2400 years.

TIMGAD. The ruins of this former Roman city of Thāmugās are near Batna in Algeria. The emperor Trajan gave orders for the building of the city in A.D. 100, and the construction took seventeen years. It became a Christian centre, but declined after the invasion of the Vandals in the fifth

century. In the seventh century it was again a Christian city, but the victory of the Arabs over the Romans in 647 resulted in its eclipse. The ruins were visited in 1765 by James Bruce and by Lambert Playfair in 1875; they have since been scientifically excavated.

TIMOR. An island of the Malay Archipelago, with a total area of 12,300 sq. miles. It is mountainous, partly volcanic, and



moderately fertile, though not as luxuriant as Java or Borneo. Maize, coconuts and coffee are grown. Sandalwood, wax and tortoiseshell are exported. The eastern part,



RUINS AT TIMGAD
Photo: Cherry Kearton

with an area of 7330 sq. miles, is Portuguese, with a population of 474,000 (1931). The port is Dilli. The western part, with its capital and port at Kupang, belongs to the Netherlands.

TIMOTHY. A co-worker with the Apostle Paul, born probably in Lystra, in Asia Minor, of a Greek father and a Jewish mother, Eunice (II Timothy 1. v). Timothy joined Paul on his second missionary journey, and continued to the end of the Apostle's life as his trusted associate and friend, succeeding him as his representative at Ephesus, of which he was made bishop. He is believed to have been martyred near the end of the first century.

The First and Second Epistles to Timothy, with the Epistle to Titus, are known as the Pastoral Epistles. See PAUL, SAINT.

TIMUR, *le moor'*, more generally known as TAMERLANE (1336-1405). An Oriental conqueror, born at Kesh, near Samarkand in Central Asia. For some years he reigned jointly over Turkistan with his brother-in-law, Hosain. He defeated the latter in battle in 1369, and became the sole sovereign, with his throne established at Samarkand. For thirty years he carried on conquests among the Mongols as far as the Volga and the Ural rivers, breaking the power of Toktamish, Khan of the Golden Horde.

In 1398 Timur invaded India and captured Delhi. Western Asia banded against him, but in a wonderful campaign of three years he ravaged Christian Georgia, took Aleppo and Damascus, defeated a Mameluke army from Egypt, and destroyed Baghdad, finally, in 1402, out-generalling Bayazeth the Turkish Sultan, and defeating his armies at Angora. All this may have been merely a prelude to the invasion of China, prevented by his death in camp. His heirs could not hold his empire together, although his son Shah Rukh established (at Samarkand) a splendid dynasty, from which sprang the Moguls of India.

Origin of Name. The name *Tamerlane* or *Tamburlaine* appears to be a corruption of *Timur-i leng*, or Timur the Lame, for he had been lamed by an arrow.

TIN. A chemical element, with the symbol Sn (from *stannum*, the Latin name for the metal). It has been in use for at least 10,000 years, being mined by the ancients in both Spain and Britain.

Tin is a soft, fairly light metal with a low melting point. Only lead among the metals possesses less ductility, that is, the power of being drawn into a wire when heated; but tin is one of the most malleable metals, and can be rolled into the very thin sheets we know as *tin foil* (which see).

Kitchen tinware is made of *tin plate*, which is very thin sheet iron or sheet steel, coated

or plated with tin. Tin alone is easily bent, and the iron or steel sheets provide strength. Since tin is not affected by ordinary atmospheric conditions, nor by weak acids found in food, it is a most serviceable material for coating containers used in canning foods. Soft solders are alloys of tin and lead; Babbitt metal, an anti-friction alloy used for bearings, is a combination of tin, copper, and antimony; and tin and copper are mixed to make bronze. Type metal is an alloy of lead and antimony, with a small addition of copper and tin. The chief ore is tinstone or cassiterite (which see).

The world production in average years is nearly 200,000 tons. Bolivia has by far the largest deposits of ore, followed by the Federated Malay States, the Dutch East Indies, China, Nigeria, Cornwall (England), Australia, and South Africa. Many of the Cornish tin mines have ceased production in recent years, either through exhaustion of supplies or uneconomic working.

Preparation for Use. The ore contains arsenic and sulphur, and this material is burned out in a furnace or in a roasting machine. If copper sulphide is present, as is often the case, it is converted into copper sulphate by this first process, and is drawn off by leaching. Next, the ore is smelted in a reverberatory furnace; it is heated for about six hours, after which the slag is removed, and then it is heated again for a similar period. The tin, in heated, liquid form, sinks to the bottom of the container, and is drawn off and run into moulds to cool.

For further purification, the ingots, as the cooled bars are called, are again placed in the reverberatory furnace and heated; the pure tin melts at 455° F. and is run into a container, leaving the final impurities behind. It is then stirred until all gases escape, after which it is cooled. In the process of cooling, the purest tin, being lightest, rises to the top of the mass, the centre being of inferior quality, while the lower layer is so impure that it must again be put through the purifying process.

TINFOIL. A thin sheet tin, often alloyed with lead. Formerly, it was made by hammering and polishing white tin, but the modern method is to run the bars of tin through a series of rollers, which press the metal into thin sheets.

TINTERN. See MONMOUTHSHIRE.

TINTORETTO, *tin tô rel' tô* (1518-1594). A celebrated master of the Venetian Renaissance, one of the world's greatest painters. His real name was JACOPO ROBUSTI; he was called Tintoretto (meaning "little dyer") because of the fact that his father was a dyer by trade. His father put him to study under Titian, and although it does not

appear that the two were ever close friends, Tintoretto's motto became "the drawing of Michelangelo and the colouring of Titian."

By the age of twenty-eight, he was painting some of his greatest religious works. Among these was a "Last Judgment," made for the Church of the Madonna dell' Orto. In 1548 he began work on four pictures for the guild-house of San Marco, a group which includes the celebrated "Miracle of Saint Mark." In 1560 he began a new labour—the decoration of the Ducal Palace in Venice—and about the same time commenced work on the adornment of the walls and ceiling of the guild-house of San Rocco. For this edifice he painted one of his masterpieces, a magnificent "Crucifixion."

In 1577 the guild commissioned him to paint for the hall and adjoining church three pictures a year, and the two structures to-day constitute a museum of his works.

Tintoretto was a consummate colourist with a remarkable faculty for drawing and a capacity for expressing dramatic action. As a portraitist, such canvases as that of the "Young Man in Armour" in the Pinakothek at Vienna prove him little, if at all, inferior to Titian. His "Saint George Rescuing the Princess from the Dragon" and "The Milky Way" are in the National Gallery, London.

TIPPERARY. See **MUNSTER**.

TIRANA, *te rah' na*. The capital of Albania (which see).

TIRPITZ, **ALFRED VON** (1849-1930) He was the first German trained as a sailor ever made Secretary of State for Naval Affairs,



ADMIRAL VON TIRPITZ
Photo: U. & U.

a position which he held for nineteen years, following his appointment in 1897. In 1911 he reached the rank of Grand Admiral, having become in 1908 a life member of the Bundesrat, the upper house of the Imperial Parliament. In March, 1916, for political reasons, he resigned all his offices. Following the German revolution in 1918,

animosity against Tirpitz resulted in his flight to Switzerland, but he returned to Berlin in 1921, and entered the Reichstag as a German National Deputy.

TISIPHONE, *tis is' o ne*. One of the three Furies (which see), attendants of Persephone the goddess of the underworld.

TISSOT, *te so'*, **JAMES JOSEPH JACQUES** (1836-1902). A French artist, born in

Nantes, whose fame rests chiefly on a series of water-colour paintings depicting the life of Christ. The collection, which consists of 350 studies, is in the possession of the Brooklyn Institute Museum. To obtain material for this labour, Tissot spent ten years in the Holy Land, and he painted with painstaking attention to detail and with extraordinary realism.

TISSUE. In biology, a structure formed of living cells and their products, which takes part in the formation of an organism, whether animal or plant. Thus we have bone tissue, muscle tissue, fibrous, adipose and epithelial tissues. Even blood is a tissue. In plants, xylem, phloem, cambium and cork are examples.

TISZA. The name of two prominent Hungarian statesmen.

Kálmán (1830-1902) worked to secure national independence. He was Prime Minister for almost fifteen years. He was mainly responsible for keeping Austria neutral during the Franco-German War, had a large share in creating the Austro-German alliance of 1879, secured for Hungary predominance in the Dual Monarchy.

Count István (1861-1918) was the son of Kálmán and also became Prime Minister. Under the Emperor Francis Joseph he had very considerable influence. A strong believer in the Dual Monarchy, he was also favourable to the German alliance so long as Hungary's sovereign rights remained. In 1914 he did all in his power to avoid war. He was forced from office in 1917 and killed in the revolution led by Count Karolyi.

TITAN, *ti' tan*. A satellite of Saturn (which see). In mythology, see **TITANS**.

TITANIUM, *ti' tan' ium*. A rare metallic element which imparts toughness and hardness to steel and lustre to silver, and increases the brightness of the flame of an arc lamp when combined with the carbon. Its salts are used in dyeing. Titanium was discovered in 1789. It is not found native, but occurs as titanium dioxide (TiO₂) in the minerals anatase, rutile and brookite, and in sphene and titaniferous iron ores. It is a greyish metal and has chemical properties similar to those of tin. It possesses to a remarkable degree the power of combining with nitrogen at a high temperature. It is widely distributed, and occurs in many iron ores. Its symbol is Ti.

TITANS, *ti' lanz*. In Greek mythology, the giant sons and daughters of Uranus (Heaven) and Gaia (Earth). Six of them were men and six were women (the Titanides). Uranus also had other children, the Cyclops and the hundred-armed giants who were so strong that Uranus greatly feared them, and threw them from Olympus down into a dark cavern

in the earth, called Tartarus. Kronos, the youngest Titan, undertook revenge on his father with the assistance of Gaia, who gave him a magic scythe. Kronos wounded his father severely, and then released his brothers and sisters, all of whom agreed that he should be ruler over them. He selected Rhea for his wife, and assigned to each of the others some portion of the earth. Later Zeus overthrew Kronos, and those Titans who did not submit willingly to his rule were



TITANS

A painting by Picaro depicting the Titans' attempt to reach Heaven by piling mountains upon one another.

Photo: Mansell

confined in Tartarus (which see). See also SATURN.

TITHES (from the Anglo-Saxon *teotha*, meaning a tenth part). Moses established the custom of tithes by levying upon the Jews a tax of one-tenth of their possessions, or profits, to support the priests. A similar custom was adopted by the Christian Church and later, several European countries exacted like levies to help pay the expenses of royalty. Tithes were known in England as early as A.D. 786, and in the course of time they became regularized in a system under which the farmer paid a tenth of his crops and produce, and offspring of his animals; the merchant a tenth of his profits; and the craftsman, the miller and the fisherman a tenth of their earnings, for the maintenance of the clergy and the care of the sick and the poor.

By the end of the Middle Ages, however, the only tithe left was that on the produce of agriculture. These were always paid in kind, the clergy taking a tenth of the milk, wool, crops, calves, lambs, pigs, etc. In 1704 Queen Anne created Queen Anne's Bounty, the governors of which, being representatives of the clergy, collect and disburse the ecclesiastical tithe rents.

In 1836, the Tithe Commutation Act converted tithes into a rent, varying with the price of corn. Disputes were frequent, and in every agricultural depression, farmers resented paying the tithe. Under an Act of 1891, tithes became payable by the owner of the land, and not by the occupier. The rise in the price of corn in 1918, which resulted in an increase in the amount of tithe, compelled Parliament to pass an Act stabilizing the position until 1925. In that year a further Act was passed stabilizing tithes for 85 years at the rate of £105 for every £100 paid in 1836. The fall in prices of agricultural products in 1930-31, however, converted tithe into a heavy burden on the landowner, and tithe "wars" broke out in many parts of the country. The Government in 1934 was compelled by the pressure of these conflicts to set up a Royal Commission. The approximate amount of tithe paid each year at that time was £3,000,000. About two-thirds of this amount was paid to the Church of England (through the Governors of Queen Anne's Bounty), and one-third to lay owners.

Arising out of the Report of the Royal Commission, Parliament passed, in the summer of 1936, legislation which will result in the extinction of tithes by the taking over by the Exchequer of the rights of the tithe-owners, who are being compensated by a 3 per cent Government Stock, amounting to £70,000,000, redeemable in 60 years.

TITHONUS, *tith o' nus*. One of the lovers of Aurora (Eos). See AURORA.

TITIAN, *tish' ian* (1477-1576). A painter, renowned as one of the world's masters of colour; the most eminent artist of the Venetian school. His real name was TIZIANO VECELLIO.

Titian began his art studies in Venice in his boyhood, and was a pupil of Giovanni Bellini. Among his fellow pupils who probably had some influence on his early work were Giorgione and Palma Vecchio. He began to work along independent lines about the year 1513. During this second or formative period, which lasted until 1530, he produced several great altar-pieces, including the celebrated "Assumption of the Virgin," which is now in the Venetian Academy. Among other well-known canvases of this period are the "Pesaro Madonna," in the church of the Frari, Venice; "Holy Family."

in the Louvre; "Bacchus and Ariadne," National Gallery, London; and a "Flora" in the Uffizi, Florence.

By 1530 Titian's fame was firmly established, and he had attained a sure grasp of his art. Princes, dukes, cardinals, Pope Paul III, Philip II and other kings, and the great Emperor Charles V were among his patrons, and he painted some magnificent portraits, notably of Charles V.

Representative of religious and mythological paintings of this period are "Christ at Emmaus," in the Louvre; "Madonna with Saint John and Catherine," in the National Gallery, London; "Venus and Cupid," in the Borghese Gallery, Rome; "Jupiter and Antiope," in the Louvre; and "Rape of Europa," in the Gardner Collection, Boston.

He died of the plague in the hundredth year of his life, and was buried at Venice in the Church of the Frari.

TITLE. A word derived from the Latin *titulus*, meaning "inscription, label, sign, or token." In the first sense, it is the designation which is used as the name of a book or to give some idea of its contents. In connection with persons, a title is an additional name which denotes a social rank above that of the mass of the people. In England, peers, baronets and knights and their wives are commonly referred to as "titled people." A quite different use of the word is found with regard to property. In this sense a title is the fact or series of facts by virtue of which a particular person is or claims to be the owner of certain property. See PROPERTY, LAW OF.

TITLES OF HONOUR. In general, any mark of rank or distinction, whether inherited, secured by merit or honorary. The modern usage, however, applies to designations of rank, not of office or calling.

TITMOUSE, TIT, or TOM-TIT. Common names for the many members of a

large family of small birds with very active and perky habits. They are mainly woodland birds and live chiefly on the insects, grubs, caterpillars, etc., which are found about trees, and sometimes on seeds and fruits.

There are several species found in Britain. The Great Tit, common in Europe and Asia, is the

largest, and can be distinguished by its black head and black stripe down the yellow underside, and by its white cheeks.

The Blue Tit is smaller and more common. The head is blue, back yellowish-green and underside yellow; there is a black stripe through the eye and a black collar.



BLUE TIT
Photo: John Kearton

Except in the north of Britain, the Coal Tit is less common than either of the last two species. The head, neck, and coat are a glossy blue-black, except for a white patch on the back of the head and the cheeks.

The Long-tailed Tit is fairly common throughout England and less common in Scotland. It is a small fluffy bird with a white head, cheeks and throat and a dark band over the eyes, and a tail as long as its body.

The Marsh and Willow Tits are much less common, the former rarely being found north of southern Scotland. These two birds are practically indistinguishable in the field, but when studied close at hand the black head of the marsh tit is seen to be glossy, whereas that of the willow tit is sooty-black.

The Scottish Crested Tits are rare and only found in old Highland pine forests.

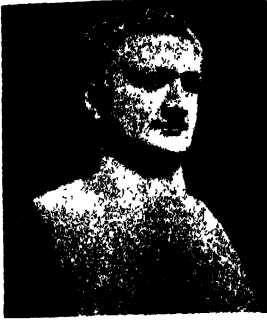
TITUS (A.D. 40-81). A Roman emperor, the eldest son of Vespasian. He was brought up at the court of Nero and served as tribune



TUFTED TITMOUSE
Photo: Visual Education Service

several species found in Britain. The Great Tit, common in Europe and Asia, is the

in Britain and Germany, as well as in Judea. In A.D. 70, during the reign of his father, Titus captured Jerusalem. On his return to Rome, he was received



TITUS

A bust in the Capitoline Museum.

Photo: Visual Education Service

with imperial honours, and shortly afterward became a colleague of the emperor. In A.D. 79, on the death of Vespasian, he became sole ruler. He showed great generosity to the sufferers in the eruption of Mount Vesuvius, A.D. 79, and to those who were affected by a destructive fire and a pestilence

which devastated Rome in the following year. Titus completed the great Colosseum, which had been begun by his father (see

COLOSSEUM), built a set of magnificent baths, and restored many ancient buildings.

Arch of Titus. A Roman arch of triumph built by the Emperor Domitian in the year 81, to commemorate the capture of Jerusalem by Titus.

TITUS. An associate of the Apostle Paul, and, so far as is known, the first Christian missionary of purely Greek birth. He was brought by the Apostle, probably from Antioch, to the council held at Jerusalem to consider how far Gentile converts should be required to conform to Jewish rites, and was excused from circumcision by the decision of that body. He accompanied Paul on many of his journeys and was appointed bishop of the churches of Crete.

The *Epistle to Titus* is of the same authorship and has the same pastoral objective as the *Epistle to Timothy*. See PAUL, SAINT.

TIVERTON. See DEVONSHIRE.

TIW, OR TYR. Norse god of war, after whom Tuesday was named.

T.N.T. See EXPLOSIVES.

TOAD. A cold-blooded animal resembling the frog. The toad makes its home in shady places in fields and gardens, and feeds



ARCH OF TITUS

Erected to commemorate the capture of Jerusalem in A.D. 70. The processional group beneath the arch represents bearers carrying the seven-branched candlestick taken from the Temple. Between this arch and the Colosseum the ancient pavement of the Sacred Way still remains.

on grubs and insects which it seizes with its sticky tongue. Toads and frogs are tailless amphibians (see AMPHIBIA). The toad's body is thicker and more bulky than that of the frog, and its movements are slower and more clumsy. Toads have a warty skin, and spend most of their lives hopping about on land. Unlike frogs, they have no teeth and cannot bite. Their skin, however, contains glands that secrete a milky fluid which

Toadflax belongs to the same family as the snapdragon (which see).

Scientific Name. The botanical name of the figwort family is *Scrophulariaceae*. The toadflax is *Linaria vulgaris*.

TOADSTOOL. See MUSHROOMS.

TOBACCO. An annual plant of the nightshade family (*Solanaceae*).

There are several species, but that designated as *Nicotiana tabacum* (native to Amer-



TOAD

Note how closely it resembles the stones.

Photo St. Clair

is poisonous to some animals. This secretion irritates, and in some cases may be poisonous to the human skin.

Toads sleep through the winter in burrows in the ground, emerging in the early spring. They migrate to the nearest pond, where they lay their eggs. These are about the size of a pinhead, and are bound together in long strands by a transparent, jelly-like substance. The small, flat tadpole is hatched in from two to four weeks, and attains adult size in about two months. (See illustration under NATURE STUDY.) The outer skin of a toad is moulted several times a year, and on each occasion it is swallowed.

Tadpoles are the prey of newts, water beetles, and fish, and the toads are eaten by snakes, hawks, crows, and owls.

The toad genus (*Bufo*) is represented in every part of the world except Australasia and Madagascar. There are about 100 species in all.

Scientific Names. Toads belong to the family *Bufo*idae. There are two British species, the Common Toad, *Bufo vulgaris*, and a smaller species, the Natterjack, *Bufo calamita*, which can be recognized by the yellow stripe down its back.

TOADFLAX, OR BUTTER AND EGGS. A weed of the figwort family, with bright-yellow flowers and pale grey-green leaves, found along roadsides and in waste places.



GIANT TOAD OF ALGERIA

Photo. Cherry Kearton

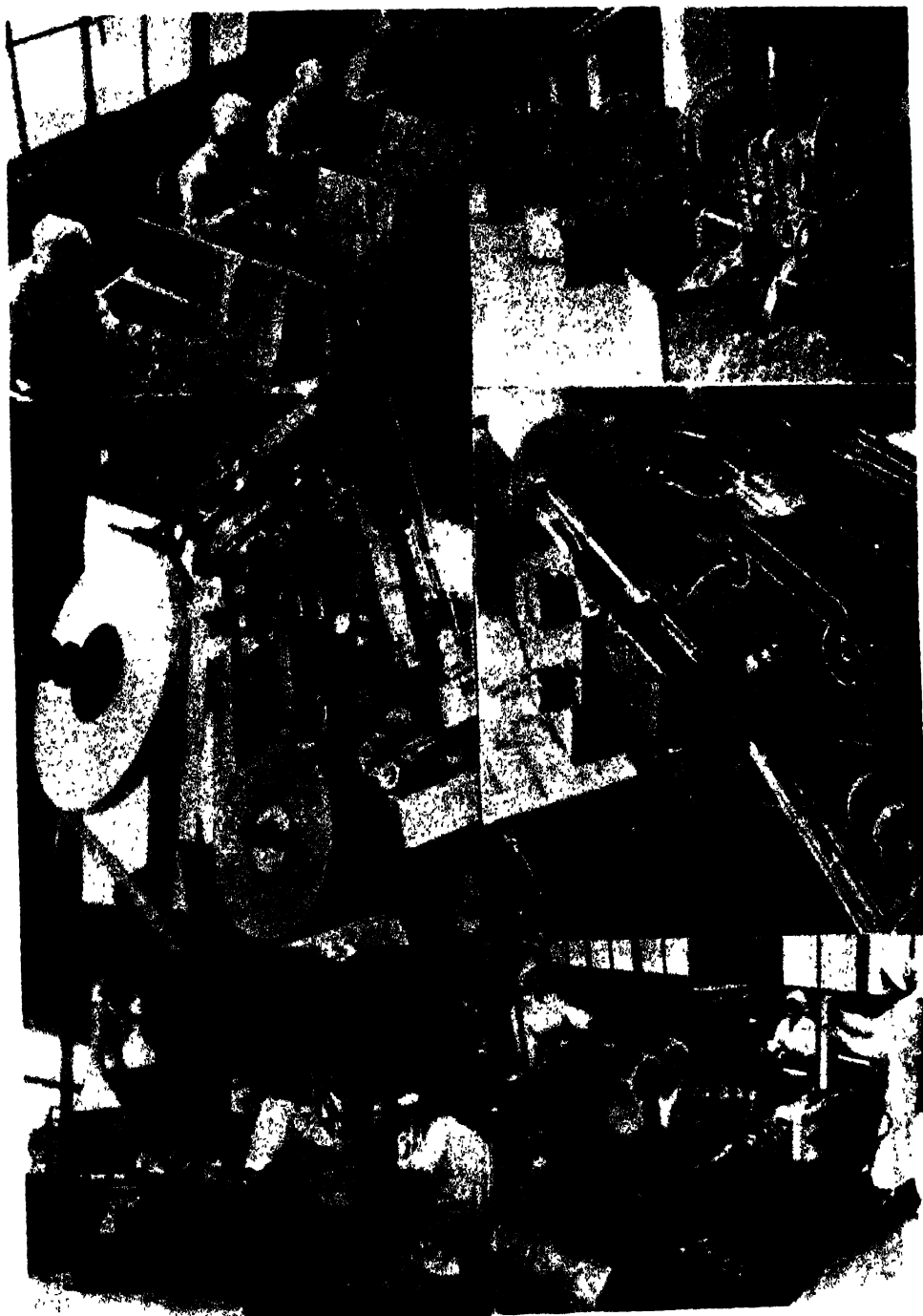
ica) is commercially the most important. This plant grows from 2 ft. to 3 ft. high, and bears long, pointed leaves and terminal clusters of rose-coloured or pink-and-white funnel-shaped flowers. The leaves grow directly from the stalk, and vary from 12 in.



HARVESTING TOBACCO IN HAMPSHIRE

Photo George Long

to 42 in. in length. The soils affect the colour and texture of the leaf and the amount of nicotine it contains. Limestone soil produces the light-coloured, mild variety; the red clay soils are best for the dark, heavy types; the light, sandy soil characteristic



PROCESSES IN CIGARETTE MANUFACTURE

From left to right: stripping the leaf; leaf cutting by machinery; rolls of paper and cork; an endless cigarette; cutting and stacking, the wrapping is done by machinery and the girl in the background puts the packets in cartons.

Photos taken at the Carreras Factory, London, and reproduced by permission of the makers of "Craven A" Cigarettes

of the state of Virginia, U.S.A., produces the yellow variety; and the strong dark *Perique*, a variety much used for smoking tobacco, is grown in heavy, black soil, such as that of Louisiana.

Tobacco is grown from seed sown in carefully prepared beds; in cold climates, the plants are started in hotbeds. When the young plants are 6 in. to 8 in. tall, usually five or six weeks after the sowing, they are ready to be transplanted. Topping of the plants to prevent flowering, and to concentrate the strength in a few leaves, is practised in the production of tobacco raised for leaves and not for seeds.

Curing. The leaves are ready for harvesting when they become a mottled yellow and green. They are cured by exposure to the air, or by the heat of open log fires, the latter method imparting a creosotic flavour, well known in some types of tobacco.

Perique, which is one of the choicest grades of smoking tobacco, is cured by subjection of the leaves to great pressure. After tobacco is cured, it is softened in moist air, packed in boxes, and taken to the warehouse, where it must undergo a "sweating."

or fermenting, process before it is ready for the market. This is for the purpose of improving aroma and texture.

Tobacco Enemies. The tobacco plant is subject to root rot; mosaic disease, or mottled top; wild-fire, and a few other diseases, but the only serious insect pests that attack it are the larvae of two species of sphinx moth, which feed on the leaves.

Production. British India and the U.S.A. are the leading countries in the production, consumption, and export of tobacco. Holland first cultivated tobacco in Europe, but the industry soon spread to other countries Russia, Hungary, the Dutch East Indies, Japan, the Philippines, Puerto Rico, Santo Domingo, Cuba, Brazil, Turkey, Greece, and Italy are other tobacco-producing countries. Since the World War, Canada has developed a rapidly growing and profitable tobacco industry.

World production in 1935 amounted to 2,100,000 tons, of which India supplied 630,000 tons and the U.S.A. 500,000 tons.

Manufacture. The manufacture of tobacco products is an industry of enormous proportions. The chief products are cigars,



A FIELD OF RIPE TOBACCO

cigarettes, and pipe tobacco. Cigars are made from carefully selected leaves, for the inner material, known as the *fillers*, must be of uniform quality. A cigar consists of core (fillers), an inner cover or binder, and an outside cover or wrapper. The two covers are made of tobacco leaf, and the outside piece is shaped so that it can be wound about the cigar in a spiral.

Some of the finest cigars are manufactured in Cuba of a native tobacco called *vuella abajo* leaf. The word *Havana* is the trade name for all cigars made from Cuban tobacco, but genuine Havanas are produced only in the island. India and Manila are the home of the *cheroot*, a large cigar blunt at each end.

History. Although it is believed that tobacco was used in China in ancient times, the knowledge of the plant and its uses spread to the rest of the world through America. At the time Columbus discovered the New World, the Indians were smoking and chewing tobacco, and using it as snuff. The plant was introduced into Spain from Santo Domingo in 1559, and in the same year, seeds were sent to France by Jean Nicot, the French ambassador to Portugal, who gave his name to the essential principle of the plant and to the genus—*Nicotiana*. Sir Francis Drake took tobacco to England in 1585, but it was through the illustrious example of Sir Walter Raleigh, who "took a pipe of tobacco a little before he went to the scaffold," that smoking spread among the Elizabethan courtiers. Although smoking was strongly opposed by the Church and State, and its devotees were threatened with severe penalties, such as the lash, excommunication, and even capital punishment, the use of tobacco spread with amazing rapidity. With the coming of the cigarette in the mid-nineteenth century its popularity was assured.

TOBACCO PLANT. See NICOTIANA.

TOBAGO, *to bay' go*. A British West Indian island 21 miles north-east of Trinidad, to which it is joined for administrative purposes. Area, 116 sq. miles; population (1934) 26,541, mainly negroes. The island is volcanic and fertile and exports tobacco, copra and cacao. It was on his impressions of Tobago that Defoe based many of the scenes described in *Robinson Crusoe*.

TOBOGGANING, *tō bog' an ing*. An outdoor sport which consists of coasting on snow or ice by means of toboggans, or sleds without runners. A typical toboggan is made of strips of wood, of which ash is the most suitable, turned up in front and fastened together by crosspieces. The surface that touches the snow or ice is highly polished and there is a light handrail on each side.

The sled is usually about a foot and a half wide and from six to eight feet long. A toboggan load consists usually of four people, the one at the rear steering with his feet. In mountainous countries, the snow-covered



TOBOGGAN RUN IN SWITZERLAND
Photo: Tonicol

hills are used for slides, but in level localities, chutes are constructed on scaffolding, with a platform at the top for the take-off. Toboggans of light steel tubing are used for racing.

Toboggans were originally built by Indian hunters as a means of carrying their game across the snow.

TOC H. An organization founded in memory of the British soldiers who were killed in the World War. The name comes from T. H., the initial letters of Talbot House, the first centre of rest and recreation of its kind. The organization as now known was established in 1920 by the Rev P. B. Clayton, M.C., a C. of E. Army Chaplain. The name Talbot was used because in July, 1915, during the first German liquid fire attack at Hooge, Gilbert Talbot, a young lieutenant in the Rifle Brigade, son of Dr. Talbot, Bishop of Winchester, was killed. In his memory there was commenced in Poperinghe five months later "Talbot House," a club for soldiers "Toc H," which is the Army Signallers' way of pronouncing the initials T. H., is an denominational institution for Christian social service. Its membership now numbers about 50,000.

TOGA, *tō' ga*. Distinctive garment of the Roman citizen. It was draped about the entire body and allowed to fall in loose, graceful folds. Originally it was worn by both men and women, but gradually, with women, it was replaced by the stola. Later the use of the toga was restricted to Roman citizens, and it was required on all formal occasions.

The shape of the toga underwent many changes, but it was usually made in an elliptical form. In the later Republic and under the Empire the toga became a voluminous garment draped in folds about the wearer.

The fabric was wool and usually white; though coloured borders or a different coloured material were used to distinguish the office or station of the wearer.



ROMAN TOGA

Bronze statuette, tunic and toga are of the voluminous form fashionable under the Empire

Photo British Museum

When the Roman youth reached the age of sixteen years, he put off his purple-bordered toga and was invested with the *toga virilis*, the toga of manhood, which was also called the *toga pura*, because it was white. The *toga praetexta*, with its purple border, was worn by magistrates and high priests. Candidates for office had their togas bleached, and the garment was called *toga candida*. The *toga picta*, as a triumphal robe, was used for honouring victors; it was probably purple and richly embroidered. Later it was used by emperors as their official dress.

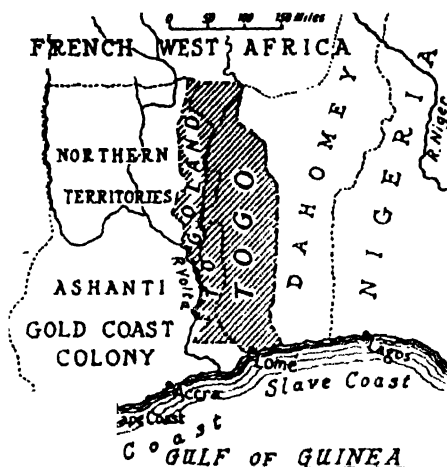
TOGO, *tō'gō*, HEIHACHIRO, Count (1847-1934). A Japanese admiral and naval hero of the Russo-Japanese War.

In 1900 he was made commander of the naval dockyards at Maizuru, and built up the navy with which he signally defeated the Russians in 1904-1905. In 1912 Count Togo was made admiral of the Japanese fleet. See RUSSO-JAPANESE WAR.

TOGO AND TOGOLAND. Since 1919, Mandated territories of West Africa, under French and British control respectively; formerly, a German colony known as Togoland, annexed by Germany in 1884 and seized by troops of France and Britain in 1914. The territory is a narrow strip extending north from the Gulf of Guinea, with Dahomey on the east and the Gold Coast Colony on the west; area, 33,700 sq. miles.

Togo. The French section occupies two-thirds of the entire area, about 22,000 sq. miles in extent, and has 753,000 inhabitants, of whom 512 are white. More than forty languages are spoken by the natives, the larger portion of whom are Bantus. The seat of administration is at Lomé, a seaport on the Gulf of Guinea, with a population of 11,000 (1933). There are several short railway lines to the interior.

Togoland. The British section is west of Togo, and borders the Gold Coast Colony, to which it is attached for administrative purposes. No part of its area of 13,040 sq. miles touches the coast. The inhabitants



number about 328,030 (1934), and of this number less than fifty are white.

The climate of Togo and Togoland is hot and unhealthy. Old Togoland was once in the centre of the slave trade. The principal exports are palm oil, kola nuts, cocoa, rubber, ivory, copra and cotton. Yams, maize, bananas, ginger, tobacco, and plantains are extensively cultivated.

TOKEN MONEY. See MINT.

TOKYO, OR TOKIO, *tō'keō*. The capital and now the largest city of the Japanese Empire, situated on the Sumida River and the Bay of Tokyo, on the south-eastern shore of the island of Honshu. Sixty miles west of the city rises Mount Fujiyama.

Tokyo is the outgrowth of a small village called Yedo, and the city which developed from this hamlet was known as Yedo until 1868. In 1922 the city was enlarged by the addition of surrounding suburbs to 161 sq. miles. Its population was 2,070,520 in 1930. The city's advance was halted, on 1st September, 1923, by a disastrous earthquake and fire. The opportunity was taken in rebuilding to modernize sanitation, architecture and public works; estimated population in 1935 was 5,662,900. The most conspicuous feature of the city is the Imperial Palace.

The river is too shallow for navigation by large vessels, and Yokohama, eighteen miles south, is the port of Tokyo.

TOLL. A tax or duty paid for the exercise of a liberty or a privilege, particularly for passing over a bridge or highway. In past centuries, bridges and highways were closed



AN AERIAL VIEW OF TOKYO

One of the overhead railway lines can be seen in the centre of the picture.

by gates that were opened to travellers only after a "toll," or fee, had been paid. The proceeds of the toll were used to meet the charges of interest on the capital that had been required to build the bridge or highway, and for maintenance. Though the toll system has nearly died out owing to the municipalization and nationalization of roads and bridges, there are still many places in Great Britain where the toll still exists: there are still a hundred turnpikes in Great Britain. At most the charge to pass is a penny or halfpenny, but in one or two instances as much as half-a-crown is charged. Local authorities can buy out the toll-gates under the Road Traffic Act.

Toll bars or *toll-gates* were the places where the toll was collected.

Customs levies by the King at ports were at one time also known as tolls.

Derivation. The word *toll* is derived from the Greek *telos*, Late Latin *tolonium*, "tax," and originally meant something counted, as tax-collectors had to count sheep and many other things.

TOLSTOY, OR TOLSTOI, COUNT LYOFF NIKOLAYEVITCH (1828-1910). Russian novelist, moral philosopher, and social reformer, born at Yasnaya Polyana, near Toula. His family belonged to the old Russian nobility.

He went to the University of Kazan, but he was in constant revolt against what he considered to be the narrowness and futility of his studies.

He left the University an ardent disciple of Jean-Jacques Rousseau, and returned to his estates determined to improve the wretched condition of the serfs. But their suspicious hostility was too



TOLSTOY

much for him, and he left his home to join the Russian army in the Caucasus.

In spite of the trials of active service, he yet found time to produce some of his best



THE HOME OF TOLSTOY IN MOSCOW
Photo OROC

work at this period—*Childhood, The Landlord's Morning, Boyhood, and Youth*.

He served during the Crimean War, and his descriptions of war scenes in *Tales from Sebastopol* made him famous in Russian literary and social circles.

The accession of Alexander II opened up possibilities of a progressive policy, especially of an improvement in the condition of the serfs, and Tolstoy seized the opportunity to write *Polikoushka*, a story dealing with the evils of serfdom. Later, after travel abroad, he opened a school in which no compulsion of any kind was used. Largely owing to the opposition of government inspectors, it was a failure.

In 1862, Tolstoy married, and to the succeeding years belong the books *War and Peace* and *Anna Karenina*; these are recognized as his masterpieces.

It was at the age of fifty that he entered upon the last and most conspicuous phase of his mental growth—his absorption in religion and ethics. He found the Orthodox religion unsatisfactory, particularly in its attitude towards war and capital punishment, and he abandoned it. He made over the ownership of all his property to his wife and heirs, and gave himself up to a life of peasant toil and simplicity.

His last great work, *Resurrection*, led to his formal excommunication in 1901, on account of its attack on the Orthodox Church.

TOLUENE, *tol' u een* Deriving its name from tolu, a balsam produced by a South American tree, toluene is extensively used in the medical profession and in the manufacture of aniline dyes, paints, pigments and perfumes. It is sometimes called methyl benzene. As the latter word implies,

it belongs to the light oils class and is secured by distillation from coal tar. It will not dissolve in water but readily dissolves in alcohol and ether. It is particularly useful in the manufacture of synthetic colourings. Also it is of great value in the manufacture of high explosives and was essential for T.N.T.

TOMAHAWK. Originally, a war club or hatchet used by the North American Indians. Tomahawks were employed in close conflicts, or were thrown with great skill from a distance, so that the sharp edge of the hatchet would strike the enemy.

TOMATO. A succulent fruit which is also used as a vegetable, and is eaten either raw or cooked. Botanically, it belongs to the same family as the potato, the tobacco plant, and belladonna.

The tomato was originally native to South America, and was first introduced into Europe as a decorative plant, the fruit being known as the *love apple*. It was not until early in the nineteenth century that it was first used as food, and the theory that it was poisonous finally disproved. In fact, as with other members of the nightshade family, the green parts contain certain



TOMATO
Blossom and fruit.

poisons. The fruit was then much smaller, was irregular in shape, and wrinkled; scientific breeding, selection, and cultivation were necessary to produce the tomato

of to-day For outdoor cultivation, seed is sown under glass, or cuttings may be taken. The young plants are transferred to field or garden as soon as the danger of frost is past. All side shoots should be pinched out, and the leading shoot stopped when four or five bunches of fruit have become set. Liquid manure is beneficial.

Tomatoes are rich in mineral salts and vitamins (which see), but have a low fuel value, owing to the high percentage of water in their composition.

Scientific Name. The tomato belongs to the family *Solanaceae*. Its botanical name is *Lycopersicon esculentum*.

TOMB. This is any chamber wherein the dead are buried. The use of tombs among the ancients was an outgrowth of a belief in the immortality of the soul. The pyramids are the impressive examples of their peculiar form of sepulchral architecture, but no less interesting are the tombs hewn in the rocks, with their numerous chambers and labyrinthine passages. The Jews made use of such rock burial-places.

The Greeks, too, constructed both types of tombs. Their raised tombs were, for the most part, very simple affairs, although in the colonies in Asia Minor, elaborate structures existed. The most famous of these was the tomb of Mausolus at Halicarnassus, from which the word *mausoleum* is derived. The Romans built their tombs on the roadsides, and along the Appian Way in the days of classical Rome were numerous tombs. The Catacombs of Rome and other cities are underground galleries with tombs hewn in the walls. The Mohammedans adopted as their favourite form the circular, domed tomb, which they modified and elaborated until it resulted in such exquisite structures as the Taj Mahal. The earliest tombs extant in Britain are the long and round barrows, burial-places of the New Stone and Bronze Ages respectively, and dating from the sixth to the second millennium B.C. This form of tomb was continued in Roman and Anglo-Saxon Britain.

In the Middle Ages, burial in churches became common, and the most important tombs of the period are to be found there.

TOMSK. See **SIBERIA**.

TOMSKY, MIKHAIL (born 1880-1936). A member of the Political Bureau which directed the policy of the Russian Revolution, he was born in St. Petersburg. For his revolutionary activities he was banished to Siberia in 1906, and thereafter until the Revolution of 1917 spent various periods in prison and exile. He became President of the Central Council of Soviet Trade Unions under Lenin and took part in various international

trade union congresses. But his Communism was of a moderate type and he was regarded as belonging to the Right Wing of the movement. On Stalin's accession to power, Tomsy's moderation conflicted with the extreme methods adopted under the Five Year Plan. He was relieved of his presidency of the Trade Unions and given a non-political office as Director-General of Soviet Chemical Industries, and later as Chairman of the State Publishing Office. In 1936 he



TONBRIDGE

The Chequers Inn and (below) the Castle.

Photos: George Long

was accused of complicity in the alleged Trotsky-Zinovieff conspiracy and escaped arrest by shooting himself

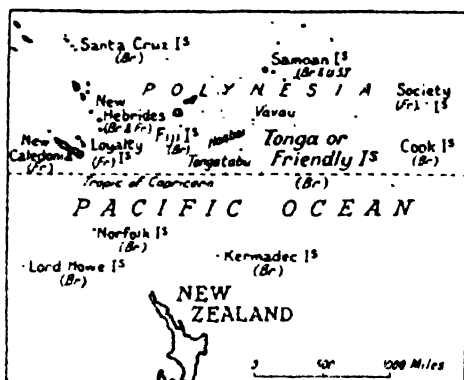
TON. In the English system, a measure of weight equal to twenty hundredweight. In Great Britain and America, a standard hundredweight is equal to 112 lb., and the ton is therefore equal to 2240 lb. In America, however, a ton of 2000 lb. is in common use, the heavier ton being known as the *long ton*, and the lighter as the *short ton*.

TONBRIDGE. An Urban District and market town in Kent, situated at the highest navigable point on the River Medway, 27

miles from London, and served by the Southern Railway. Tonbridge School was founded in the reign of Edward VI. Population 16,332.

TONE. A musical term denoting the sound made by the vibrations of a piano, violin, harp, or other musical instrument, or by the human voice. Tones differ from one another in quality, pitch, intensity, and duration. The word *tone* is also applied in music to the larger intervals in the diatonic scale, as distinguished from the semi-tones, or smaller intervals. See Music.

TONGA OR FRIENDLY ISLANDS. A group of about 100 islands in the south-west Pacific between latitude 15° and 23° 30' S.,



and longitude 173° and 177° W. Most are low-lying coral islands, but a few are volcanic and lofty. The largest is Tongatabu. The total land area is 385 sq. miles and the population 30,482 (1934), including 378 Europeans. Nukualofa is the capital. The islands were discovered by Tasman in 1643. A British protectorate was proclaimed in 1900; a native queen, however, is still the nominal ruler.

TONG KING OR TONKIN. See FRENCH INDO-CHINA; INDO-CHINA.

TONGUE. The flat, muscular organ in the mouth, which serves as the principal organ of taste and is an important aid in the formation of sounds and in the process of chewing and swallowing. The tongue, which is composed of striped muscle fibres running in various directions, is attached to the hyoid bone at its root end; by virtue of this arrangement, one can move the front part in many different ways to deal with food and to form sounds.

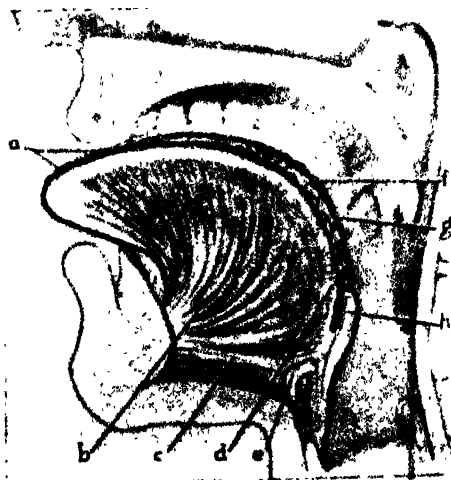
The tongue is covered with mucous membrane which, on the dorsum, or upper surface, has numerous tiny conical elevations called *papillae*. These give the organ its rough feeling. The papillae at the back of the tongue contain the taste buds. Besides

muscles and taste buds, the organ has glands which secrete mucus, a moistening fluid. In ordinary health, the tongue is a pinkish-red colour, but when the digestion is impaired, a yellowish coating generally forms.

TONIC (in music). See KEY.

TONNAGE, *ton'ayj*. The carrying capacity of a ship, measured in cubic-foot tons. The gross tonnage contains 100 cubic feet to the ton, and this is the unit of measurement used in assessing dock and harbour dues and in fixing the fee for towing. Gross tonnage is ascertained by dividing the volume (in cubic feet) of the interior of the ship's hull and deck houses by 100.

TONNAGE AND POUNDAGE. Import duties imposed in Tudor and Stuart times. Under the Tudors and James I. Parliament granted these duties to the king for life, and they constituted an important part of the revenues of the Crown. On the accession of Charles I the growing determination of the Commons to keep a tight hold on public expenditure led to their granting the king tonnage and poundage for one year only. Charles, being unable to obtain a renewal of the grant except on conditions which he was unwilling to accept, tried to exact the duties without the consent of Parliament, contending that he was entitled to raise revenue for necessary public purposes by virtue of his



TONGUE

View from the side

(a) Papillae; (b) Flat triangular muscle (genioglossus); (c) Geniohyoid muscle; (d) Lymphoid follicle; (e) Hyoid bone; (f) Taste buds; (g) Glands in soft palate; (h) Epiglottis.

royal prerogative. In 1641 the Long Parliament formally declared that the levying of tonnage and poundage without consent of

Parliament was illegal. See CHARLES I; HAMPDEN, JOHN; SHIP MONEY.

TONSIL. One of a pair of soft, almond-shaped bodies lying in the back of the mouth, in front of the pharynx, one on each side of the throat. These organs are of very little use, and when they become inflamed, they are a source of pain and annoyance. Not only do diseased tonsils cause tonsillitis and quinsy (see those titles), but they are often the seat of infection from which germs may spread, producing rheumatism and other ailments. The tonsils may be removed without danger.

TONSILLITIS, *ton sil' i' tis* (less correctly spelt TONSILITIS). A painful disease resulting from inflamed tonsils. It is caused by lodgment of disease germs in one or both of the tonsils. Overwork, taking cold, and dissipation are some of the predisposing causes. Attacks of tonsillitis are most common in persons between the ages of ten and forty. An attack begins with swelling and pain in the throat, and difficulty in swallowing. It sometimes results in an abscess behind the tonsil, known as a quinsy (which see).

Tonsillitis is not usually fatal, but many recurring attacks tend to make the tonsils permanently diseased, in such a case, the tonsils should be removed. Mild cases of tonsillitis usually yield to gargles, rest in bed, hot or cold compresses on the neck, and the administration of purgatives.

TONSURE, *ton' shur*. The cutting or shaving of the hair to denote dedication to clerical or monastic life. In the Roman Catholic and Greek Churches, the act is one of preparation for receiving Holy Orders, and is performed by the bishop. Clerical tonsure was mentioned as early as the fifth century, and in the Middle Ages the practice became universal. Various modes of cutting the hair are adopted in different countries and among different religious orders. Among the secular clergy in the British Isles the tonsure is not worn permanently, but on the Continent of Europe the crown of the head is usually shaved.

TOPAZ, *tó' paz*. A mineral composed principally of aluminum, silicon, and fluorine, and occurring chiefly in granite and gneiss. It is often a valuable indicator of the presence of tin ore. In hardness it ranks between sapphire and quartz. Crystallized, transparent varieties are valuable as gem stones, especially the colourless and yellow topazes. Red, blue, and green stones also are found. The best specimens of gem topaz are taken from the Ural Mountains; they are found also in Brazil, India (including Ceylon) and the United States. To the topaz the ancients attributed power to cure dimness of vision

and to dispel gloom, and it is regarded as a peculiarly "lucky stone" for those born in November.

The so-called *oriental topaz* is a variety of corundum. See GEMS.

TOPE. The coasts of the English Channel and of West Wales are the hunting grounds of this small but very destructive shark. The fish, which preys on lesser species, is capable of doing much damage to the gear of line fishermen, and, on account of its strength, is keenly sought by sea anglers. Tope reach a length of about 5 ft. and are typically shark-like in colour and shape. The young are born alive.

Scientific Name. *Galeus vulgaris*.

TOPOGRAPHY. See GEOGRAPHY.

TORNADO, *ter nay' dī*. A violent whirling storm which occurs with greatest frequency in the central part of the Mississippi



APPROACH OF A TORNADO

Photo P & A

Valley, U.S.A., usually in the months of May, June, and July. Tornadoes also occur occasionally in Canada, in Australia, and in some parts of Europe. *Tornado* is a Spanish word meaning "twisted," in reference to the shape of the storm cloud.

Tornadoes usually form within thunderstorms, and they occur on warm days, when the humidity of the air is excessive. The tornado cloud is a densely black, funnel-shaped mass, pointing downward from dark storm clouds in violent commotion. This



TORNADO SWEEPING OVER THE PRAIRIE
Swirling sand can be seen where the twisting cloud touches the ground.

Photo: P. & A.

funnel-shaped cloud is the storm centre, and the velocity of its whirling movement is thought to be 400 or 500 miles an hour in some cases. The condition giving rise to such a cloud may be described as a condition of unstable equilibrium in the atmosphere, with a warm layer of humid air next to earth, and a cooler layer above it. A disturbance in the atmosphere causes an upward current in the warm air, and as the current rises, a rotary movement is caused by the inrush of cold air from surrounding areas. The whirl is so rapid at the centre that a small area of low pressure is produced, the temperature is reduced, and condensation of moisture takes place; thus the cloud is formed. One often sees miniature tornadoes in open spaces on a hot afternoon, in little whirling eddies of dust. Waterspouts at sea are similar to land tornadoes.

These storms usually travel at the rate of 40 or 50 miles an hour, but velocities of 100 miles per hour have been recorded. The destructive power is not in the straight wind, but in the rotating area, which whirls counter-clockwise. Though the path of the storm may be only a few rods in width, within that path buildings are torn down and trees are uprooted.

TORONTO, 16 rom' 16. Capital of the province of Ontario, and, except Montreal, the largest city in the Dominion of Canada;

it lies on the north shore of Lake Ontario, near its western end. Population, 631,027 (1931). The harbour, which was originally responsible for the growth of the city, is land-locked and has been much improved, making Toronto one of the most important centres of lake commerce.

Among the notable public buildings are the City Hall, with its massive tower, 300 ft. high; Osgoode Hall, the seat of the law courts; and the Parliament House.

Commerce and Industry. Toronto is Ontario's chief commercial city, its trade in groceries and shoes being especially noteworthy. It is also a great insurance and banking centre.

Toronto has more than 3000 manufacturing establishments, its yearly output being about one-eighth of Canada's total. It is the great slaughtering and packing centre of Canada, and it has a large output of machinery, lumber, books, and various iron and steel products, including rails and stoves. The shipbuilding yards are also important. Power for all this plant is derived entirely from Niagara Falls, through the management of the Ontario Hydro-electric Commission. Light and heat for the city are obtained from the same source.

Institutions. There are two cathedrals--St. James's (Anglican), and St. Michael's (Roman Catholic). The city is the educational centre of the Dominion, with the University



CITY HALL, TORONTO



A VIEW OF TORONTO
Photo Canadian Pacific Railway

of Toronto and its colleges of Victoria, Trinity, and St. Michael's, Hart House, one of the finest students' unions, and Upper Canada College, the oldest secondary school in the Dominion.

Toronto has the Canadian National Exhibition, which is held in permanent buildings on the lake shore for a fortnight in early September.

The Dunlap Observatory, 12 miles north of the city, with a telescope containing a 74-in mirror, was opened in 1935. See Articles under CANADA, in Dominion's Volume.

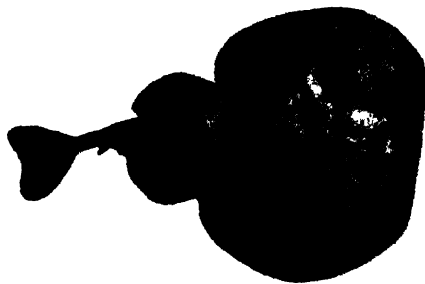
TORPEDO, or ELECTRIC RAY. A ray found in warm seas, so called because it can apparently discharge electricity from special organs lying in the head and gill region. Its body is flat and broad, dark above and white below, and ends in a slender tail. The torpedo uses its strange power to kill small fish for food, in a full-grown, healthy fish, the shock is powerful enough to disable a man. After discharging electricity, the fish is temporarily exhausted. See ELECTRIC FISH.

Scientific Name. The torpedo of British coasts, known also as the cramp fish, is *Torpedo nobiliana*.

TORPEDO. A modern weapon of naval warfare. The term was originally applied to the type of weapon which is now known as the *submarine mine* (see MINE), but soon after the development of the locomotive torpedo it came to be appropriated exclusively to the latter weapon.

The limitations of the moored torpedo (or

mine) had long been obvious, and much thought was given to the production of a mobile weapon. Among the most successful of the early attempts was the *spar torpedo*. This consisted of a long spar rigged out over the bows of a steamboat, and carrying at its outer end an explosive charge. It was the



TORPEDO RAY
Photo Herridge

object of the attacking boat to approach her enemy until she could actually place the end of the spar with its explosive charge, lowered under water for the purpose, against the hull and then fire it by means of an electric current. Spar torpedoes were used with effect during the American Civil War (1861-65).

Other torpedoes developed were the *Brennan*—purely a harbour defence weapon—which was propelled and also steered by means of two wires reeled in by a steam engine on shore, and the *Howell*, which derived its motive power from a heavy flywheel which was spun up to a high speed just before the torpedo was fired.



AT PORTSMOUTH
Photo Photopress

One of the men at work on the idea of a self-propelled torpedo was a Captain Lupus of the Imperial Austrian Navy. He managed to enlist the interest of Robert Whitehead, a Scottish engineer practising in Fiume. In 1856 Whitehead produced his torpedo. Although by modern standards its performance was feeble—it had a speed of 6 knots for a few hundred yards only—it incorporated many of the characteristic features of the weapon of the present day. Two years later he achieved such success with an improved model that the British Admiralty purchased all rights in his invention for £15,000.

Structure. The torpedoes in use to-day by the different navies naturally vary somewhat in general design and a good deal in detail; but the layout shown in the line diagram may be taken as typical.

At the forward end is the head. The *war-head* contains the charge, which in the largest torpedoes may be upwards of a quarter of a ton of high explosive. It is exploded by means of the *pistol*, which is operated by impact with the hull of the vessel attacked.

Next to the head is the *air vessel*. This is a thick-walled compartment in which air is stored at a pressure of about a ton to the square inch. Aft of the air vessel comes the *balance chamber*, which contains the depth-keeping mechanism—hence its name—and the three most important components of the

heater system: the fuel reservoir, the water reservoir, and the generator. The next compartment aft, the *engine room*, differs from all other compartments in the torpedo with the exception of the tail, in that it is not watertight. It contains the engine which drives the propellers, the starting and reducing valves, and the servomotor which operates the horizontal rudders. Next again is the *buoyancy chamber*. As its name implies, it provides a large part of the necessary reserve of buoyancy, and it also houses the gyroscope. Last of all comes the *tail*, with the tail fins and vertical and horizontal rudders. It also contains the gearing which causes one propeller to rotate in the opposite direction to the other.

In the earliest torpedoes the air in the air vessel provided the sole motive power. But shortly before the World War *heater* torpedoes began to be introduced. In them steam became the main medium of propulsion, and the outcome of the innovation was a very considerable improvement in speed and range. The most popular form of engine appears to be a four-cylinder radial single-acting type, although the Americans manufacture a torpedo driven by a turbine. The engine drives the aftermost propeller by means of a hollow shaft which also acts as the exhaust pipe. It is this exhaust which gives rise to the characteristic track which a torpedo leaves in its wake. The forward propeller is carried on a hollow sleeve shaft

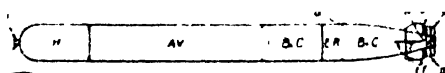


DIAGRAM OF A MODERN TORPEDO

H = Air Vessel BIC = Balance Chamber
ByC = Buoyancy Chamber ER = Engine Room
H = Head T = Tail al = Air Lever
hr = Horizontal Rudders p, p = Propellers, pl = Pistol
tf = Tail Fins vr = Vertical Rudders

which revolves upon the main shaft, its direction of rotation being reversed by gearing. Thus the torques of the two propellers cancel out and so assist to keep the torpedo upright.

Steering. The torpedo is steered for depth by a mechanism comprising a spring-loaded hydrostatic valve and a pendulum. The valve is exposed to the pressure of the sea-water which will vary as the torpedo rises above or sinks below the depth for which it is adjusted. The resulting movements of the valve are communicated to the horizontal rudders through an air-driven

engine termed the *servomotor*. The purpose of the pendulum is to prevent the torpedo assuming an excessive upward or downward inclination, which might be the case if it were subject to the influence of the valve alone. Direction is maintained by means of the *gyroscope*. The principle on which this device works is precisely that of the child's

varied in relation to the direction in which the tube was pointing.

It is a requirement of International Law that a torpedo fired in war shall sink at the end of its run, as otherwise it would turn into a drifting mine.

Discharging. In the early days of locomotive torpedoes, various means for dis-



THE DISCHARGE OF A TORPEDO

The torpedo is shown at the instant of firing from the tube of a British destroyer. To the left of it can be seen the tracks of torpedoes fired just previously.

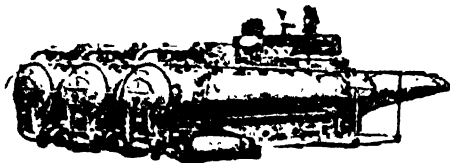
Photo: Fox

spinning top. The gyroscope consists of a heavy wheel which is freely suspended, and is spun up to a high rate of rotation at the moment of discharge. It thus tends to maintain its axis pointing in a direction parallel with that in which it was pointing at the instant of discharge, irrespective of the movements of the torpedo. The relative movement between gyroscope wheel and torpedo is communicated to a valve controlling an air-operated steering engine, which in turn works the vertical rudders. By an ingenious arrangement the gyroscope can be adjusted so that, immediately after discharge, the torpedo will turn through a predetermined angle, thus enabling the direction in which it will actually run to be

charging them were devised. The most common was the *gun* or *tube* from which the weapon was expelled by the agency of compressed air or the gas from a small explosive charge. As the torpedo passed out of the tube a *tripper* engaged the *air-lever* on the torpedo and threw it back, thus starting the engines.

Modern torpedo tubes fall into two main types, *above-water* and *submerged*. The tubes in all torpedo craft, and cruisers of the most modern design, are of the former class. Above-water tubes may be built into the ship's structure, but most commonly they are mounted on the upper deck, two, three or four together on some form of turntable. This arrangement allows them to be kept

trained fore and aft, out of the way, at ordinary times, and to be swung outboard when action becomes imminent. In destroyers and torpedo-boats, which have a comparatively narrow beam, it is the general practice to mount the torpedo tubes on the



A MODERN ABOVE-WATER TORPEDO TUBE

The tube illustrated is of the 21-in. triple type, and was constructed by Messrs. Peter Brotherhood, Ltd., for the Yugoslav flotilla leader *Dubrovnik*.

Photo: Peter Brotherhood, Ltd.

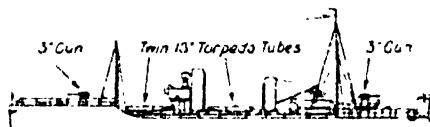
centre line, so that the whole torpedo armament can be fought on either broadside.

Submerged tubes were introduced to overcome the danger, inherent in the above-water type, of the warhead being prematurely exploded by shell-fire while yet the torpedo is in the tube. For technical reasons submerged tubes can only be installed in ships of the larger classes. Where these tubes are mounted on the broadside—the most common arrangement—their operation is complicated by the necessity for protecting the torpedo as it emerges from the tube from the rush of water past the orifice, which would tend otherwise to damage or even jam it. The difficulty is overcome by means of some form of shield which can be rigged out just before firing, and serves to steady the torpedo until its tail is clear of the tube.

In submarines the tubes are necessarily of the submerged type.

TORPEDO-BOAT. A vessel specially designed for the conduct of torpedo warfare. The type really gained importance after the invention of the locomotive torpedo (see above), although a certain number of boats had been constructed previously to operate the spar torpedo. Its essential characteristics are small size and high speed, so that it can strike rapidly and with a good chance of escaping observation and also avoiding being hit by gunfire, while its comparative cheapness enables it to be constructed in large numbers. Torpedo-boats were taken up with enthusiasm by both the Russians and the French, who added large numbers to their fleets. Britain at first adopted rather a hesitant attitude with regard to them, but in the end she too acquired a considerable number; and by the close of the nineteenth century practically every navy of consequence possessed a flotilla.

So seriously did the British Admiralty regard the menace of the torpedo-boat that, besides equipping the larger ships with numbers of quick-firing guns and searchlights as an anti-torpedo-boat armament, they also devised special types of ship as a counter measure. First of all they produced the *torpedo-gunboats* (or *catchers*) which were a failure. These gave place to the *torpedo-boat destroyers* (see DESTROYER), which were really enlarged and faster torpedo-boats in which the torpedo armament had been slightly reduced and the gun armament considerably increased. As a result they came more and more to perform the functions of torpedo-boats, until they eventually displaced them. Germany, who always regarded attack with the torpedo as the supreme function of all torpedo craft, never adopted the classification of "destroyer," but designated vessels of this type *large torpedo-boats*. Torpedo-boats have, however, continued to find favour with many of the lesser Powers. During the last few years the type has begun to reappear. Japan has introduced a class of vessel displacing about 550 tons with a speed of 26–28 knots and an armament of three 4.7 in. guns and three or four torpedo tubes, and Italy and France

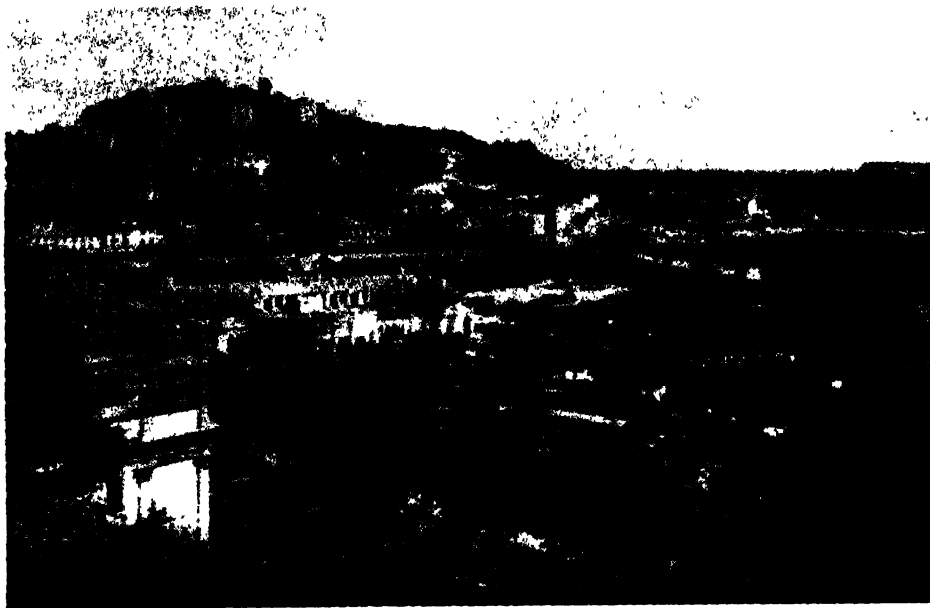


NORWEGIAN TORPEDO-BOAT "SNOGG"
220 tons; 23 knots, completed 1916.

are acquiring a number of similar if rather smaller vessels.

Motor Torpedo-boats. These vessels are a special development of the torpedo-boat. First put into service during the World War, they were originally called *coastal motor boats*. The British vessels were light craft 40 ft. to 55 ft. long, having a speed of 34 to 38 knots and armed with one or two torpedoes, depth-charges and Lewis guns. Although unsuited for work in the open sea, they did good work in the Channel and southern part of the North Sea, in the Caspian, and after the War in the Baltic during the operations against the Bolsheviks. They rendered invaluable services at the blocking operations against Zeebrugge and Ostend, but their most spectacular exploit was when six boats raided the harbour of Kronstadt (1919) and sank two Bolshevik battleships and a depot ship.

After some years of neglect, British interest in this type of boat is reviving, and a number of an improved design are in course of being brought into service.



TORQUAY

Princess Gardens, the Harbour, and Vane Hill, seen from the Rock Walk.

Photo. G.W.R.

TORQUAY, *tor ke'*. Municipal Borough and most frequented watering-place of South Devon, with an area of 6243 acres and a population of 46,165 in 1931. The town is situated on the shores of Torbay, faces south-west and is built on seven hills which protect it from the cold winds of the north and east. The site of the present Torquay is modern, but Torre Abbey was a priory of Premonstratensians founded in the latter part of the twelfth century, and much of the Abbey ruins dates from this period. One of the three original gate-houses cannot, however, be earlier than the fourteenth century. Kent's Cavern is of the greatest geological and antiquarian interest, for the discovery of early flint instruments and of the bones of men and animals shows this to have been the habitation of Palaeolithic cave-dwellers. The Borough includes the neighbouring watering-place of Babbacombe and also the thatched village of Cockington. Two special features of Torquay are the wealth of semi-tropical vegetation and the numerous bays and small coves in the district.

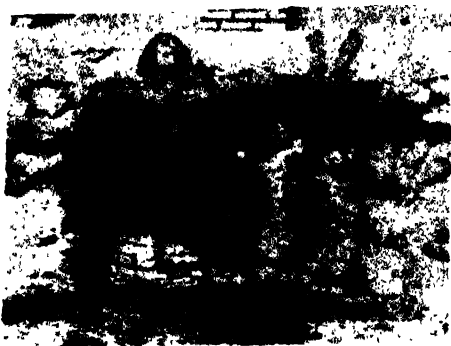
TORQUEMADA, *tor keh mah' da*, TOMAS DE (1420-1498). Born at Valladolid, he became a friar preacher in the Dominican monastery in that city. For twenty-two years he was prior of the monastery of Santa Cruz at Segovia, and was confessor to Isabella, afterward Queen of Spain. In

1478 the Inquisition was reorganized in Spain; Torquemada, through the aid of Ferdinand and Isabella, was made assistant to the inquisitors, and in 1483 was elected inquisitor-general, a position which he retained for eighteen years, sentencing to death over 10,000 persons in that time for political or religious offences, but the sentence was carried out in only about one-fifth of the cases.

His severity was rebuked by the Pope, and he had frequently to send embassies to Rome to defend his methods. He took part in the expulsion of the Moors from Spain, and was largely instrumental in driving the Jews from the country. He finally retired into a Dominican monastery at Avila. See INQUISITION.

TORRENS SYSTEM. A system of registering titles to real estate, devised by Sir Robert Torrens, who introduced it in South Australia in 1858. By 1874 the system was in use in each of the colonies of Australia, in Tasmania, and in New Zealand. It has since been extended to Canada and other British possessions, the United States, and many of the countries of Europe. The purpose of the system is twofold—

1. To make the transfer of landed property as simple and safe as that of other property.
2. To do away with the repeated examination of titles.



TORTURE

A man buried as a punishment in Persia.

Photo: Topical

The system is operated through a bureau or court of registration in charge of a registrar, with whom, in most cases, is associated an examiner of titles. In brief, it substitutes public registration for conveyancing.

The official certificate becomes the title of ownership and is *indefeasible*; that is, it cannot be set aside or overcome.

TORRICELLI, *tor re chel' le*, EVANGELISTA (1608-1647). An Italian scientist, famous for his discovery of the principle of the barometer (which see). Torricelli succeeded Galileo as professor of philosophy and mathematics in the Florentine Academy.

TORRID ZONE. See TROPICS, ZONE.

TORSION BALANCE. See GEOLOGY.

TORT. This has been defined by various authorities as a private, or civil wrong or injury, independent of contract, a breach of a legal duty, and a violation of anyone's right to personal security, to liberty, to property, or to reputation. The shortest and commonest definition is "a civil wrong." A tort differs from a crime in that the latter is an offence against the State, while the former is an offence against an individual.

Tort is the term used to designate the branch of law which treats of the redress of injuries not classified as crimes or as breaches of contract. In this branch are included slander, libel, trespass, assault, conversion, nuisance, and negligence.

The usual remedy for a person injured by a tort is to bring an action for damages against the person who has committed the tort or in certain cases against his employer. See MASTER AND SERVANT.

Derivation. The word *tort* is derived from the Latin *torquere*, "to twist" a tort therefore means literally a twisted or crooked act.

TORTOISE, *tor' tōs*. See TURTLE.

TORTOISESHELL. See TURTLE.

TORTURE. The infliction of severe physical pain by the use of the rack, scourge, or other instrument. In Greece, slaves were examined under torture; under the Roman Empire, it was also inflicted upon freemen. In Europe, generally, in the Middle Ages and later, torture was common to procure confessions of guilt.

By the seventeenth century, public sentiment had been generally aroused against the practice, but it lingered in various parts of Europe until the early part of the nineteenth century. Its use in Catholic countries was prohibited in 1816 by a Papal bull.

TORY. See CONSERVATISM; POLITICS.

TOSSING THE CABER. See CABER.

TOTALIZATOR, *tō tal' iz ay' tōr* (or "Tote")

A mechanical means of dealing with bets on horses at race meetings so that the agency of a bookmaker is dispensed with. The minimum stake, made by the purchase of a ticket, is 2s., and as many multiples as desired can be taken by the person betting. The total speculated thus on each race is pooled and then divided amongst those whose stakes are on the winning horse. Place stakes can be made and are similarly pooled.

TOTEM, *tō'tem*. Among primitive peoples, an object regarded as the symbol of a tribe, clan, family, or individual. The totem may be a bird, fish, beast, or any other object. Sometimes the totem is looked upon as the tribal object of worship.

The practice of carving totem figures on poles is common in many North America.



TOTEM POLES

Photo. Canadian Pacific Railway

Indian tribes, especially those of the Pacific coast.

TOTNES. See DEVON.

TOUCAN, tu kahn'. A bird of tropical and semi-tropical America, which has an enormous beak, a thick, short body, and short legs. The upper mandible is curved over the lower and is notched at the edges. In a tropical species of Brazil and Guiana, the beak is 8 in. long and 3 in. high at the base. The tongue, also, is curiously flattened and notched, and the bird's tail is joined to its body by a ball-and-socket joint, which permits of its being raised above its back with a



TOUCAN

Photo: South Line

jerk, as if operated by a stiff spring. Toucans are brilliantly coloured, their black or green bodies are marked with red, orange, white, or blue, and the beaks are crossed with vivid bands. They feed on fruit, small birds, lizards, and other animals. Their eggs, pure white in colour, are deposited in holes in trees. In the Andes they are found at an altitude of 10,000 ft.

Classification. Toucans belong to the family *Rhamphastulæ*. The typical species are placed in the genus *Rhamphastos*.

TOUCH. One of the five special, or exterior, senses, the one which gives to the individual his most intimate knowledge of material objects. This tactile sense is perceived through the stimulation of sensory nerves which have their end-organs in the skin and the mucous membranes. See SENSATION.

TOULON, tu loN'. See FRANCE.

TOULOUSE, tu looz'. See FRANCE.

TOURACO, too ra ko'. A large bird peculiar to the tropical forests of Africa. These birds are sometimes called "Plantain-eaters" and "Lauries." A curious thing about the red colour, present in their wings, is that it is washed out with heavy rain, but it is subsequently renewed.

Classification. The touraco belongs to the family *Musophagidæ*.

TOURMALINE, too' ma lin. A common mineral, which is found chiefly in granite, gneiss, and mica schist. The mineral is harder than quartz and will easily scratch glass. There are three types, differentiated according to the oxides present—the black or iron tourmalines; the brown, or magnesia, and the alkali tourmalines of rich reds, greens, and blues. Pink and red tourmaline gems are known as *rubellite*, or *Siberian ruby*, the colourless as *achroite* and the blue and green stones as *indicolite*, or *Brazilian sapphire*. Black opaque varieties are known as *schorl*.

The Ural Mountains, the island of Elba, Brazil, Maine (in the vicinity of Paris), Siberia, and Ceylon are famous for bright-coloured tourmalines, and much of the achroite also comes from Elba. Blue varieties are found in Sweden and America, and the black stones occur in Norway, England, Greenland, and the Tyrol. Gem tourmalines are also found in Madagascar.

Crystals of tourmaline split up any ray of light directed through them. Also, under the impulse of heat or pressure, their electrical balance is changed, one end becoming negatively charged, the other positively. These properties are made use of in research. (See POLARISCOPE and POLARIZATION OF LIGHT.) With the opal, the tourmaline is a birthstone for October.

TOURNAMENT, OR TOURNEY. The mimic battles of mounted knights in the Middle Ages, who displayed their military prowess by tilting with sharp or with blunted lances or by fighting with swords. Minute regulations were enforced, which lessened the danger of the tourney, although there were sometimes combats à l'outrance, or "to the death." In every tournament there were a great many single encounters, as well as combats between parties of knights, known as *mêlées* or *mellays*.

The tournament is said to have originated in the tenth century, but was most popular during the eleventh, twelfth, and fifteenth centuries. The first combats were held in France, but the custom spread to England, Germany, and the south of Europe. Tourneys gradually changed from real trials of strength to tests of skill, such as running at the ring, and to occasions of elaborate display.

TOURNIQUET, *toor' ne kel*. An instrument or device used to check bleeding in an accidental wound, or to stop the flow of blood during an amputation. A simple tourniquet, for use in case of emergency, can be made from a cord, handkerchief, or other piece of cloth. If the wound is a cut artery—and in that case bright-red blood will spurt out in jets—tie the cloth around the limb at a point between the wound and the heart, slip a short stick into the loop, and twist the stick until the bleeding is checked. It is best not to permit the tourniquet to remain tight for more than half an hour at a time, for it is liable to cause necrosis or gangrene of the limb. If nothing is at hand to make a tourniquet, compress the bleeding vessel with a padded key, or even the finger. If the haemorrhage is from a cut vein, causing an even flow of dark-red blood, a tourniquet is not required, a firm bandage over the wound is sufficient. See FIRST AID TO THE INJURED, HAEMORRHAGE.

TOURS, *toor*. See FRANCE.

TOWN CLERK. The officer of the council of a Borough or a County Borough in England and Wales who is responsible for the convening of the council and recording its deliberations. The term is sometimes applied loosely to the clerk of an urban district council. Usually the town clerk is a lawyer capable of advising the council in its rights and obligations and of acting for it in a court of law.

TOWN-PLANNING. The control exercised over undeveloped land to ensure that when development does take place it shall be according to a plan prepared in the interests of the whole of the community. After the Great Fire of London in 1666, Sir Christopher Wren propounded his scheme for planning the new London—wide avenues radiating from a central open space, with a circular road all round the City. But the scheme was defeated by the opposition of the landowners, so the new London grew up in chaos.

There is evidence of attempts to plan in the squares of the West End of London, but it was not until the Housing and Town Planning, etc., Act, 1909, that the problem was tackled centrally. Local authorities were called upon to submit their plans to the Local Government Board, later the Ministry of Health. Further Acts were the Housing and Town Planning Act, 1919, the Town Planning Act, 1925; and finally, the Town and Country Planning Act, 1932, in which provision was made to protect rural amenities as well, and to preserve buildings and other objects of interest and beauty. Provision is made for compensation to be paid to landowners who will be adversely affected

and for betterment to be paid by those whose property will benefit by the schemes.

Closely linked up with the question of planning is the problem of *ribbon development*. To save the expense of laying down access roads, builders have erected houses and factories on to the frontage of main and secondary roads, with the result that pedestrians are endangered, stationary vehicles outside these premises cause obstruction and delay to through traffic on the highway, and the beauty of the countryside is being marred by the development of land by frontage instead of by depth. The Restriction of Ribbon Development Act, 1935, has given the local authorities power to prohibit the erection of a building within 220 ft. of the middle of a Class 1 or a Class 2 road, and the option of applying to the Ministry of Transport for power to control similarly the erection of buildings on the unclassified roads.

TOWNSHIP. A term derived from the Saxon, where the settlement was the "tun" or town, the area of which was the "tun-scipe," which became the town-ship. The name may be used of any urban area not known as a city. More definitely it refers to any urban area which has powers of local government.

TOWTON, BATTLE OF. See ROSES, WARS OF THE.

TOXAEMIA, *toh se' mia*. See BLOOD; TOXINS.

TOXICOLOGY. See PHARMACOLOGY.

TOXINS, *toh' sinz*. Poisonous substances formed by the growth of bacteria. Some toxins remain within the bacteria, and others are secreted by them. Many bacterial diseases are the result of poisoning by toxins, such as diphtheria and lockjaw. Both diseases are *toxæmias*. Some antitoxins are made by injecting toxin into large animals.

TOYS. Playthings of children, usually devised as artificial helps in child mimicry. Throughout history they have reflected the fashions and interests of the day.

The jointed wooden dolls and the crocodiles with movable jaws, found in the tombs of ancient Egypt, are typical of that period, while the tops and hoops with which the Roman children played prove that child nature and child desires have changed little through the centuries. Roman boys played at chariot-racing with improvised chariots, and the boys of the Middle Ages fashioned for themselves standards ornamented with the Cross of the Crusaders.

Every advance in science left its mark on the toy-making of the day. When the balloon ascents of the Montgolfier brothers were holding the attention of the world (see BALLOONS), children everywhere were amusing themselves with toy balloons. When

motor-cars became practicable and common, the toy machine followed close upon the real one; the same tendency is visible in the case of the aeroplane.

The making of toys has become a vast industry in recent years. For a long time, however, the manufacture of these child necessities was practically confined to Europe, the French making the costly and beautiful toys, the Germans the simpler and more practical ones. Nuremberg long has been the centre of toy-making in Germany. Since the World War, however, almost every country has established factories. Great Britain has a high reputation for the toys, both soft and mechanical, produced in its factories.

TRACERY. The intersecting rib work, bands, and fillets in the upper part of Gothic windows, used for support and for ornamentation. The term is also applied to the interlaced work of a vault, walls, or panels in Gothic churches and cathedrals, and may be extended to similar forms used in relief as wall decoration (sometimes called *wall tracery*), hence, figuratively, it may refer to any intricate line pattern. The art of tracery was first practised in Gothic architecture in France and England in the thirteenth century (See illustrations on page 4264.)

The chief forms of tracery include the *geometric*, with bars or ribs all about the same distance from one another; the *flowing*, with free, curving lines; and the *flamboyant*, with flowing and swaying lines.

Fan Tracery. This is a form of ornamentation used on the interior surface of vaulted roofs. It is an elaborate, carved tracery which spreads out like the folds of a fan. The best examples are seen in buildings of Perpendicular period, such as King Henry VII's Chapel, Westminster Abbey, King's College Chapel, Cambridge, and the cloisters of Gloucester Cathedral.

TRACHEA, *trá ké' á*, OR **WINDPIPE**. The principal air tube in the human body. The trachea starts at the pharynx, and can be felt in the front part of the neck as a section of hard ridges. It ends below by dividing into the right and left bronchial tubes, and through these structures communicates with the lungs (see LUNGS). The larynx, or voice box, is a modified part of the trachea. In an adult, the windpipe is about three-fourths of an inch in diameter. It consists of a supporting layer of connective and muscular tissue, lined with mucous membrane, and its walls are kept from collapsing by incomplete rings of hard cartilage, which enclose the tube at the front and on the sides. The back of the tube rests against the oesophagus.

TRACHODON. See DINOSAURS.

TRACHOMA, *trá kó' má*. See BLINDNESS.
TRACHYTE, *trák' ite* or *tray' hite*. A volcanic rock consisting chiefly of alkali feldspars and a small amount of biotite, hornblende, or augite. The name is derived from the Greek *trachus*, "rough," and was applied to it because the small, lath-like crystals make the broken surfaces of specimens rough to the touch. In colour, trachyte ranges from pale grey through pink to black. It occurs in Haddingtonshire and the N.W. of Dartmoor, along the River Rhine and in Italy, France, the Azores, and in the United States.

TRACTARIANS. See OXFORD MOVEMENT.

TRADE. See COMMERCE.

TRADE, BOARD OF. As a permanent Department, the Board of Trade dates back to the Commonwealth. The Council of Trade and Plantations was established in 1660 for the purpose of collecting statistics and information with reference to the nation's trade. The present department owes its origin to an Order in Council of 1786, by which the Committee of Council for Trade was appointed and an establishment of clerks attached to it. In 1862 the popular title of the Board of Trade was first adopted by statute.

Constitution. The Board of Trade is an executive Committee of the Privy Council, and consists of a President, who is a Member of Parliament, and the following *ex-officio* members: His Majesty's Principal Secretaries of State, the First Lord of the Treasury, the Chancellor of the Exchequer, the Speaker of the House of Commons, and the Archbishop of Canterbury. The Board never meets, but periodical meetings take place between the President and the heads of the various departments.

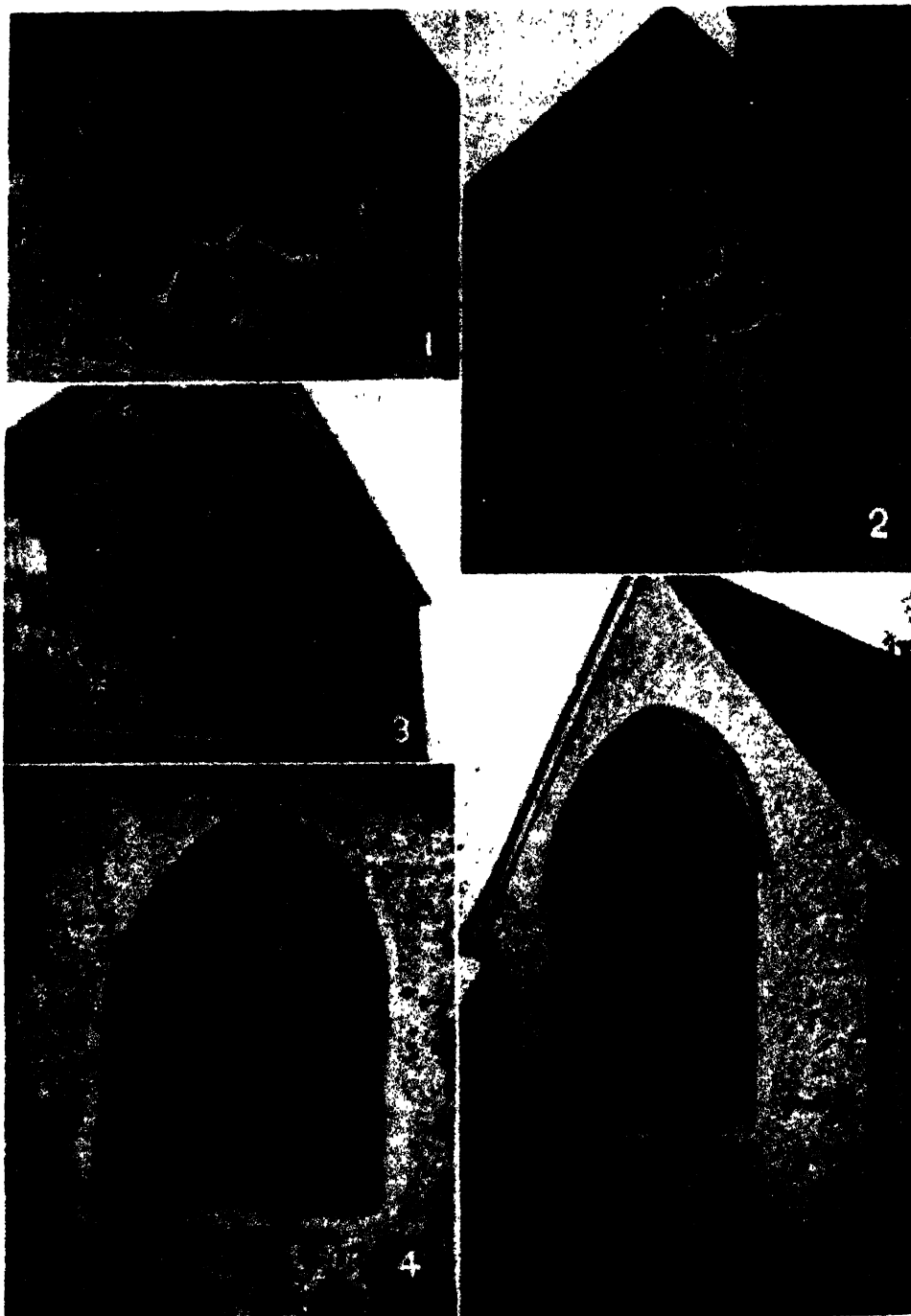
The duties of the Board of Trade are, broadly, to encourage and supervise the trade and industry of the country, and also to enforce certain statutes relating to trade.

Departments. Since January, 1918, the Board has been organized in two main divisions: (1) the Department of Commerce and Industry, and (2) the Department of Public Service Administration. There are also three general departments.

1. The Department of Commerce and Industry is concerned mainly with the development of trade. The department is divided into the following—

The Commercial Relations and Treaties Department looks after the commercial interests of this country in regard to conventions and treaties with other countries.

The Mines Department (including the Petroleum Section) is for the purpose of securing the most effective development and utilization of the mineral resources of the United Kingdom, and the safety and



FORMS OF TRACERY

1. A circular Norman window at Barfreston Church, Kent, showing the origin of tracery. 2. An early (1270) essay at bar tracery in the window of the south chancel of Godalming Church. 3. The east end of Great Bookham Church, a good example of fourteenth-century (circa 1341) net tracery. 4. Tracery of the Decorated style at Sbere Church (north transept). 5. Mid-fifteenth century east window of the chancel at Merstham Church, a handsome example of late Perpendicular style.

Photos. Dr. Wulfred Haaper, Taylor

welfare of those engaged in the mining industry.

The Department of Overseas Trade (Development and Intelligence is a joint department of the Board of Trade and the Foreign Office. It deals chiefly with existing and possible trade with other countries. It now has control of the Consular and Attaché Services.

The Industries and Manufactures Department (including Gas Administration) deals with the development of industries, paying special attention to the influence of foreign manufacturers upon British production.

The Standards Division is now merged in a new department known as the *General Department*, which also deals with merchandise marks and food. It has the custody of imperial and secondary weights and measures, and controls the administration of the Weights and Measures Acts.

The Patent Office and Industrial Property Department administers the Patents, Designs, and Trade Marks Acts, including the Registration of Trade Marks.

The Statistical Department centralizes and consolidates the work of the Board of Trade in collecting and classifying the statistical returns which are issued periodically.

The Intelligence and Parliamentary Branch keeps in touch with the Committee of the Privy Council on Scientific and Industrial Research, with the Imperial Institute, and the National Physical Laboratory.

2. The Department of Public Service Administration is primarily engaged in statutory and other administrative functions of a permanent nature with regard to trade and transport. The divisions of this department are—

The Mercantile Marine Department (including Consultative Branch and Sea Transport Department) deals with all matters concerning the mercantile marine, including the supervision of ships and appliances. It also administers H M Coastguard, and also exercises control over the principal lighthouse authorities.

General Register and Record of Shipping and Seamen also keeps the logs of ships and official shipping records.

The Companies Department deals with legislation in regard to the Government control of joint-stock companies under the Companies Act, 1929, the Registration of Business Names Act, 1916, the Assurance Companies Act, 1909, and the Arts Union Act, 1846.

The Bankruptcy Department is responsible for administration of the law relating to bankruptcy and deeds of arrangement.

3. Three General Departments, viz. the Finance Department, the Solicitor's Depart-

ment, and the Establishment Department; these are really internal departments.

Besides these divisions, there are certain temporary departments, most of which are the outcome of the World War.

TRADE BOARDS. If any industry or branch of an industry appears to need wage regulation the Ministry of Labour under the Trade Boards Acts of 1909 and 1918 has power to form a Trade Board consisting of representatives of employers and workers together with members appointed by the Ministry. The Board has power to fix time and piece wages and also overtime rates for the whole industry, any process or special area. They were of particular value in the chaotic situation that followed the end of the World War. Since their inception wage rates have been improved in many occupations. In 1924 the principle was applied to agriculture.

TRADE COMMISSIONER. An officer of the Department of Overseas Trade whose duty is to watch British interests in the Dominion or Colony to which he is attached. He keeps in touch with the trade centres of his area and notifies the mother country of important impending contracts for which he thinks British firms might tender. Possible openings for new industries are watched for, and he reports on all legislation likely to affect British trading interests in his area.

TRADE-MARK. A mark, sign, device, word, or picture printed or stamped on manufactured goods for purposes of identification. It may be registered in the Patent Office and its use prohibited to all except the owner.

The first legislation on the subject was an Act of 1862; the present law is contained in the Trade-Marks Acts, 1905 and 1919. Under these Acts a register of trade-marks is kept at the Patent Office in London, there are also two branch registers, at Manchester and Sheffield, for cotton and metal goods respectively. The register is divided into two parts, A and B; registration in Part B confers a lesser degree of protection, but the conditions for registration are less stringent. Registration is for fourteen years in the first place, but the term is renewable from time to time.

Registration in Part A. Any "device, brand, heading, label, ticket, name, signature, word, letter, numeral or any combination thereof" may be registered in Part A, provided that it embodies at least one of the following features, namely (a) the name of a company, person or firm represented in a special or particular manner, (b) a signature, (c) an invented word or words, (d) a word having no direct reference to the character or quality of the goods and not being a

geographical name or surname, (e) any other distinctive mark. Once a trade-mark is registered in Part A, the registered proprietor of the mark is entitled to bring an action against anybody who uses the mark without his consent, and will be awarded damages and (if necessary) an injunction.

Registration in Part B. A mark which does not qualify for registration in Part A may be registered in Part B, if it has actually been used as a trade-mark in the United Kingdom for at least two years.

TRADE NAME. The name under which a person or firm carries on business. A trade name to which an established goodwill has become attached may be a valuable asset, and, like a trade-mark, it is protected by law against deceptive imitation. See **TRADE MARK**.

TRADE UNION. See **LABOUR ORGANIZATIONS**.

TRADE WINDS. Winds that blow regularly from about the twenty-eighth parallels of north and south latitude toward a low-pressure belt at the equator. They blow from the north-east in the northern hemisphere and from the south-east in the southern hemisphere. The trades blow very steadily and in a uniform course over the oceans, and in the days of sailing ships navigators greatly depended upon them. It was the regularity of these winds, especially over the oceans, that gave them their name, the term "trade" being used in its old and obsolete sense of *course*, or *track*. The course of the "trades," as sailors call them, over land areas is irregular, because of variations in temperature, influence of mountain barriers, and various local disturbances.

These winds are a part of the great system

of planetary winds caused by differences in temperature between the equatorial and Polar regions. The great heat of the equatorial region causes the air in the Torrid Zone to become rarer and lighter, and consequently there is an upward current into the higher atmosphere. The surface currents from cooler regions north and south, which flow into the equatorial belt to take the place of the ascending currents of warm air, form the trade winds. The fact that they blow obliquely, instead of directly north and south is due to the rotation of the earth on its axis. This movement turns them from a straight course, and makes them easterly winds. The belt between the two sets of trade winds is a region of calms. The trade-wind zone itself shifts north and south with the seasons.

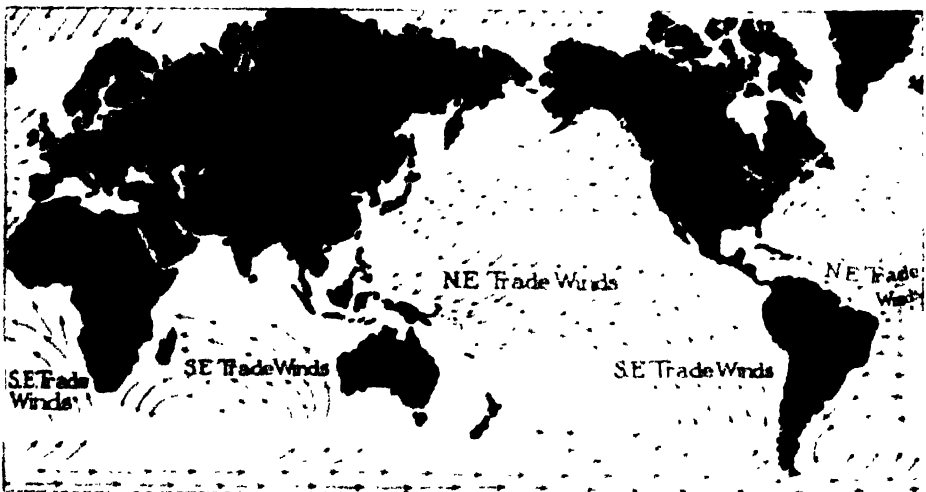
TRAFAL GAR, BATTLE OF. See **NELSON OF THE NILE**.

TRAFFIC REGULATIONS. See **ACCIDENTS; HIGHWAYS, MOTOR-CAR**.

TRAGEDY. A form of drama which calls for a serious theme, dignified treatment, and usually a disastrous ending.

The word tragedy literally means "goat-song" (Gr *tragos* he-goat, *ôdê* song). It seems originally to have been a hymn or choric ode sung at the festival held in honour of Dionysus. The meaning of "goat-song" is uncertain: one explanation is that a goat, the destroyer of vines, was sacrificed to Dionysus, the wine god, during the singing of the ode.

But very little is known of the origins of tragedy, since the earliest extant specimens of it--the tragedies of Aeschylus, Sophocles, and Euripides--show it already highly developed and strictly controlled by metrical laws and the three famous Unities.



THE TRADE WINDS

the Unity of Time, limiting the duration of the action of the play to twenty-four hours; the Unity of Place, confining the action to one place; and the Unity of Action, forbidding any independent underplot.

The Latin poets were disciples and imitators of the Greek drama. Latin tragedy is represented by the plays of Seneca. Although they are markedly inferior to the work of the Greek tragedians, they are important in the history of tragedy, since it was Seneca and not the Greek tragic writers whom the experimenting dramatists of the Renaissance took as their model.

Before the revival of classical tragedy at the Renaissance, a tradition of tragic drama was established and kept alive by the anonymous authors of the medieval Mystery and Morality plays. In England, they produced some fine work, including the Brome play of Abraham and Isaac and the morality play known as *Eeveryman*. Perhaps these plays would best be called tragi-comedies, according to the definition of tragi-comedy as serious drama in which the outcome is happy.

The first English tragedy written at the Renaissance was Senecan in style, e.g. the play called *Gorboduc*, by Sackville and Norton, which is the first blank-verse tragedy written in English. But the Senecan tradition was short lived in England; it was broken first by Marlowe and later by Shakespeare, Dekker, Heywood, Webster, Beaumont and Fletcher—in fact, by all the great Elizabethan dramatists except the classically-minded Ben Jonson.

In contrast to the English dramatists, the great French playwrights, Corneille and Racine, followed a severely classical tradition.

The Romantic movement produced some fine poetic drama, e.g. the plays of Goethe (especially his *Gotz von Berlichingen*) and Schiller, of Victor Hugo and Rostand, and of Byron and Shelley. Shelley's poetic tragedy *The Cenci* (1819) is a noble work.

Famous modern writers of tragic drama include Henrik Ibsen, August Strindberg, Bernard Shaw, Anton Tchekhov, and Eugene O'Neill. See DRAMA.

TRAGOPAN, *trag' o pan*. A handsome bird of the pheasant family, found in the forest regions of the Himalayas. It is noted for bright, variegated plumage, and for two fleshy protuberances which hang behind the eyes.

Scientific Name. There are five species, belonging to the family *Phasianidae*. The best-known species is the crimson tragopan, or horned pheasant, of India, *Tragopan satyrus*.

TRAJAN, *tray' jan*, MARCUS ULPIS TRAIANUS (52 or 53–117). A Roman Emperor,

born near Seville of a Roman family. His father was a common soldier of the legion, who became consul and governor of Asia. Trajan, after the usual military education, won distinction as a military tribune in Spain, Syria, and Germany. In 97 Nerva adopted him as his son and successor, and in the next year he became emperor.

Much of his reign was spent away from Rome in campaigns on the frontiers of the empire. Dacia and Armenia were conquered and made provinces, and Syria, Mesopotamia, Arabia, and Parthia, which had become almost independent, were again reduced to submission. In 106 Trajan celebrated at Rome a splendid triumph. During the latter part of his reign Trajan built the Forum named after him. He also built new roads and aqueducts, new harbours on the coast, and encouraged agriculture. By pursuing a moderate domestic policy, and with the proceeds of his aggressive foreign policy, Trajan lessened taxes, corrected abuses in the laws, and improved the administration of the provinces. He permitted a persecution of the Christians.

Trajan's Arch. A marble arch at Benevento erected in A. D. 113, in commemoration of the opening of a new road to Brundisium.

Trajan's Column. A column erected by the Senate and people of Rome in A. D. 112, in honour of Trajan. The column itself is 100 feet high, and was formerly surmounted by a colossal figure of Trajan, which was replaced in 1588 by a statue of Saint Peter.

TRALEE. The county town of County Kerry in the south-west of the Irish Free State. It is a seaport, being situated on a bay of the same name. It has a population of 10,533. Tralee is served by the Great Southern Railway of Ireland and is 21 miles north of Killarney. Bacon and ham curing are important, and grain and butter are the chief exports. There are ruins of a Dominican monastery which was founded in 1213.

TRAMWAYS. An English coachmaker named George Shillibeer in the early years of the nineteenth century designed a car for street passenger transport which ran on four wheels and was first seen on the streets of Paris, where it was known as the *voiture*



TRAJAN
British Museum

omnibus. Passenger vehicles of similar style were run in New York, U.S.A., as early as 1832. In London, tramcars drawn by horses and running on wheels on rails along the roads came into use seventy years ago. These tramcars were drawn by two horses, a third horse being added to deal with sharp ascents on sections of the routes. Steam trams followed in some districts in London, at Wantage and other places in the provinces, and in places abroad. The next step was a system of cable haulage. First used in American cities in 1873, this system was introduced into England in 1884. There was a trial track laid on Highgate Hill, London, as an experiment, and the next important and entirely successful development was the track from Kennington Church to Brixton Hill in South London. The propelling power was a cable or endless wire rope laid in a conduit beneath the surface of the roadway. The endless wire rope was driven by a motor placed near the line, and "grippers" attached to the cars provided the means of starting or stopping the tramcars. Electric tramcars followed. Now, in consequence of the pressure of traffic on the roads, there is an increasing supersession of the electric tramcars, running on fixed rails, by omnibuses free of all road rails and receiving their electric power from overhead cables. They are known as trolley-buses.

TRANCE. A term used very loosely, as a rule, to describe any kind of semi-consciousness or sleeping state that is abnormal. Originally, its use implied a belief that the soul of the person in a trance was temporarily withdrawn from the body. Now, however, the word is applied to a variety of sleep-like states, including ordinary sleep-walking, the deeper stages of hypnosis, extreme cases of lethargic melancholy, and the condition into which spiritualistic mediums seem to fall almost at will. The so-called ecstatic trance may apparently be induced through excitement, especially of a religious nature, and is characterized by an outward appearance of rapt contemplation. On returning to a normal state, the subject usually remembers the nature of his vision, or other ecstatic experience.

TRANSCAUCASIAN REPUBLIC. One of the Socialist Soviet republics including those regions which lie south of the Caucasus mountains. It has an area of 71,255 sq miles. Within the republic are three minor republics, Georgia, Armenia, and Azerbaijan (see those titles). Besides cotton and cereal crops, minerals are of importance, including oil, coal, and manganese ore.

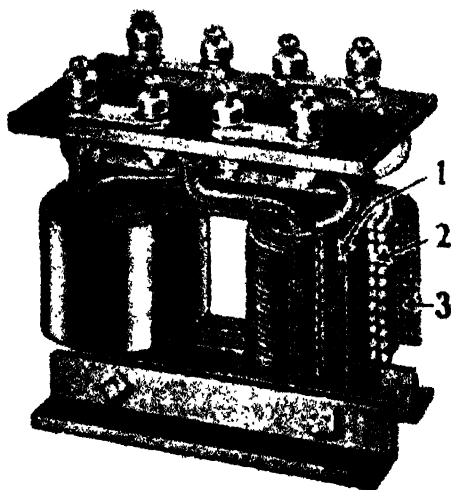
TRANSCENDENTALISM. *tran sen den' tal iz'm*. A term applied to any philosophy

which seeks to show that reality and knowledge are interdependent. The term is associated particularly with the idealistic philosophy of Immanuel Kant. Its original conception was due to Duns Scotus. Kant's ideas were taken up and expounded in England by Carlyle and Coleridge. See **METAPHYSICS**.

TRANSEPT. See **CATHEDRAL**.

TRANSFORMATION OF ENERGY. See **ENERGY**.

TRANSFORMER. Michael Faraday, in 1831, discovered that if a current is sent in



TRANSFORMER

1. Laminated iron core
2. Primary circuit.
3. Secondary circuit.

alternating directions through a wire it causes an electromotive force in a nearby wire. Thus, if a hollow square or core of iron has the wires of one circuit wound around one side, and those of another circuit around the other, a transformer is created. If an alternating current is sent through the first circuit, it causes shifting lines of magnetic force, which induce in the other circuit an electromotive force in the other direction. In general, if there are twice as many loops of wire in the first as in the second coil, the voltage of the second coil will be halved and its amperage doubled.

TRANSFUSION OF BLOOD. See **BLOOD**.

TRANSIT. In astronomy, the crossing of one heavenly body over the disc of a larger one, as seen from the earth.

TRANSITIONAL BENEFIT. See **DOLE**.

TRANS-JORDAN (incorrectly, **TRANSJORDANIA**). So named because it is across or beyond the River Jordan; it is a part of

Arabia governed, since 1923, by an independent Arab administration subject to the control of the British Mandate over Palestine, with the approval of the League of Nations. Before the World War and the successful revolt of the Arabs against Turkey, it was a Turkish governorship under the vilayet (province) of Damascus.

Palestine, the Dead Sea, and the River Jordan lie to the west, and Syria to the north. To the east is Iraq (Mesopotamia), and to the south lie Hejaz and Nejd. See ARABIA.

The population is about 300,000, of which more than 260,000 are Arab Moslems. There are about 30,000 Arab Christians of various sects, and 10,000 Circassians, the latter in colonies planted there by the Ottoman government after the Russo-Turkish War of 1877-1878. Approximately half the population is nomadic, while the other half live in villages and small towns, chief of which are AMMAN, the capital, with 20,000 population, Es-Salt, Kerak, Irbid, and Maan. Most of the country is desert, almost the only arable region being a thirty-mile district between the River Jordan and the Hejaz railway. Agriculture and cattle-raising are the chief occupations; the recovery of salt, potash, and phosphate from the Dead Sea promises to become an important industry. A motor road from Amman to Jerusalem, and a portion of the Hejaz railway running through the country, are the only modern means of transport.

History. The area was under Egyptian

rule from the twelfth to the sixteenth centuries, and then under Turkey until the break-up of the Turkish Empire in the World War.

In 1918 the Bedouins rebelled against the Turks. In September, 1918, the Turkish garrison of Maan surrendered to the British,

marking the end of the Ottoman period, and by the Versailles Peace Treaty (1919) this territory was made part of the Palestine Mandate under the supervision of the British High Commissioner of Palestine. During the revolt Great Britain promised that the success of the rebellion would make Arabia independent. As a result of this promise and of the treaty, Emir Abdullah was approved by the British as ruler of the Trans-Jordan territory.

In May, 1923, local autonomy was granted in principle. In November, 1927, a treaty was signed between the British government and the Emir Abdullah, by which the independence of the Trans-Jordan government was

formally recognized. The Legislative Assembly first met in 1929.

British interests are represented by a High Commissioner; because of duties which pertain jointly to Trans-Jordan and Palestine, one High Commissioner serves for both countries.

Occasional trouble has occurred since the treaty, which was unpopular, and some of the Bedouin tribes of Trans-Jordan were restless during the anti-Jewish troubles in Palestine in 1929 and 1936. A movement



IN TRANS-JORDAN

Top: Bedouin sheiks at the door of the ruler's palace
Bottom: the town of Es-Salt, near the Palestine border.

Photos U & U.

exists among the Arab population for the union of Trans-Jordan with Palestine into a single state on the lines of Egypt and Irak; this, however, is part of the larger racial problem in Palestine (which see).

TRANSMIGRATION OF THE SOUL. The belief that the soul, after the death of the body, takes to itself another body, either human or animal. It presupposes immortality. Among the Brahmanic Hindus, it has its foundation in the belief that the soul must ascend to God by stages, and according to the goodness or badness of one's life so one's next life is on a higher or lower plane. The caste system is closely allied to this belief.

The Buddhists believe that the soul must be free from passions and desires, which may necessitate many incarnations, before it reaches Nirvana, or absorption into the stream of universal consciousness. See **BRAHMINISM; BUDDHISM.**

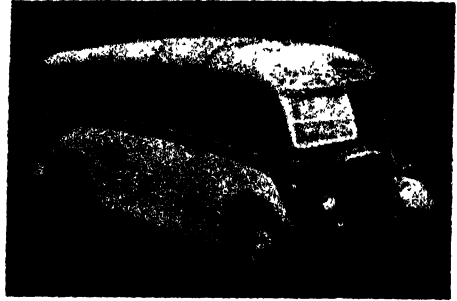
In ancient Egypt, the belief was closely connected with the system of animal worship. Transmigration of the soul was also taught by the Greek philosophers Pythagoras and Plato, and Caesar tells us that the belief was current among the Gauls.

TRANSMITTER. See **TELEGRAPHY; TELEPHONE; TELEVISION; WIRELESS.**

TRANSPIRATION. See **BOTANY; EVAPORATION; LEAF.**

TRANSPORT. In the modern organization of life, transport is one of the indispensable factors. Progress in civilization throughout the ages has been brought about by transport. Without some form of carrying or movement, trade would be non-

existent only within the period of the last century. Little or no change or development took place from the earliest Bible times until James Watt recognized the power of steam. The same means of movement and conveyance obtained from the age of the Pharaohs until the eighteenth century. Human bearers, pack horses, animal-drawn vehicles working over tracks or



A LONG-DISTANCE COACH

Photo: Levland Motors

through bush and forest, and crude sea and river craft offered the means of transport throughout that long period.

Sea and Inland Waterways. It is obvious that in these mankind had a ready-made means of transport. We have ample proof of this in the fact that all the world's oldest important cities and towns are situated either by the sea or on a river.

Large-scale transport became a vital necessity when mankind began to live in camps and settlements, and the increase in population made it imperative for a wider search to be made for food and the necessities of life. Warfare made it essential for craft to be provided of suitable calibre to convey fighting-men by the waterways. The Egyptians of 3000 B.C. are said to have been responsible for the first ship, as distinct from other small craft such as rafts or canoes. By A.D. 850 the Vikings had explored the limits of the known world. The oared galley and sailing boat were plying in the Mediterranean before the Christian Era.

Britain, since her industrial development, has come to possess an extensive system of inland waterways. As the need arose, the improvements of rivers was the first objective. Efforts were made to eradicate silting, and in some cases to cut a new water-course to avoid a twist in the river's route.

But owing to the difficulties and cost of making rivers suitable for the increasing traffic, and because often there were no suitable rivers near the deposits of coal, canals were introduced. It must, however, be noted here that Nebuchadnezzar placed



ASCENDING SNAEFELL MOUNTAIN

Photo: Isle of Man Publicity Board

existent. Raw materials are useless at their origin; they are only valuable when delivered at the place where they can be usefully employed in manufacture.

The two main functions of transport are the conveyance of passengers and animals, and the conveyance of goods and materials for exchange, sale or manufacture.

The progress of transport has been spec-



PRIMITIVE FORMS OF TRANSPORT

1. Native bearers in Africa. 2. Chinese coolie. 3. Crude handcarts are commonly used in the interior of China. 4. Camel carriage photographed near Delhi. 5. A "prairie schooner" such as was used extensively by the pioneers in Canada and America. 6. Wooden, springless carts drawn by cattle are common in India. 7. A caravan of camels and cattle crossing a stream in Burma. 8. A Mexican Carretta. The inscription on the heavy wooden wheel declares it to be more than two hundred years old.

Photos: Visual Education Service

on record that he repaired the canals of Babylon, while Herodotus speaks of a canal across the Isthmus of Suez completed in the sixth century B.C. The latter would, no doubt, be the forerunner of the Suez Canal as we know it to-day.

The earliest forms of water craft included rafts, canoes, and catamarans. These

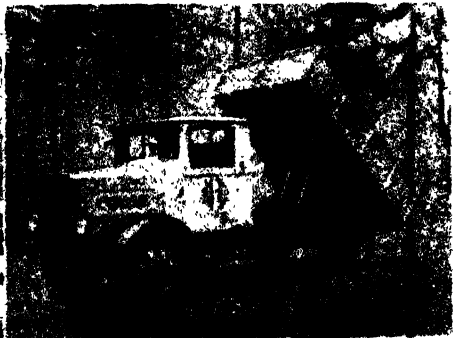
Roadways. There is no record of the antiquity of desert tracks and routes, but in countries where large areas of forest and bush were common it is unlikely that tracks led far from the main settlements. Later, military considerations were responsible for an improvement in tracks and the creating of some sort of highways. The Romans in



Left: A very early model. Right: A six-cylindered heavy duty two-axled machine with trailer
Photos: Leyland Motors

took the form of bark or skin spread over a framework, or a pair of canoes lashed together to form a single craft. The use of oars, paddles or rudders followed. The first known development of water craft used in the carrying of goods was the use of the skins of animals sewn up, with air blown into them; thereafter they were as far as pos-

sible made airtight and tied together, and trunks of trees placed upon them. This made a craft of considerable buoyancy. Three thousand years ago huge blocks of stone used in the construction of old Assyrian palaces were conveyed from the quarries by this means. For the evolution of the modern steamship, see SHIPS.

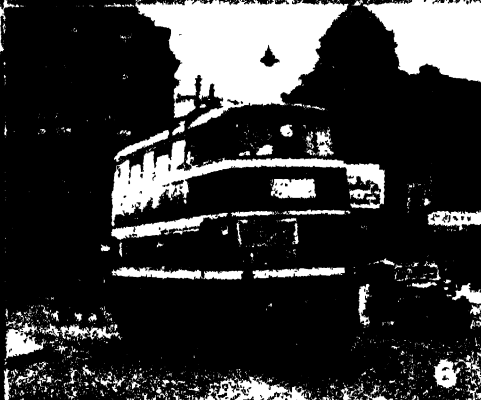
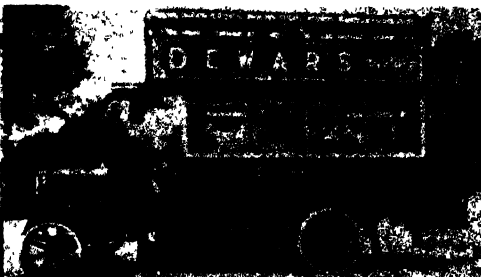
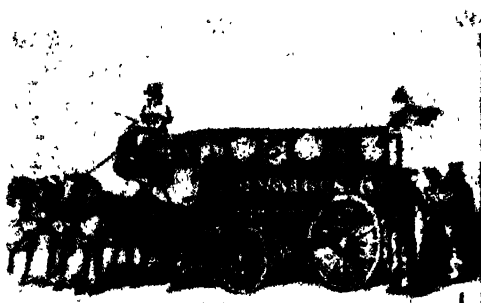


HEAVY DUTY TRANSPORT LORRIES
Left: Fifteen-ton "Octopus" type. Right: Three-ton tipper.
Photos: Leyland Motors

sound engineering practice. (For later developments, see ROADS AND ROAD-MAKING.)

The most primitive method of land conveyance was mankind's own broad back, head or shoulders. We still see evidence of this even in Great Britain, where porters offer to carry our luggage. On the continent of Europe and in the Far East it often

the early centuries during the creation of their Empire, stretching from the North Sea to Africa and from Spain to Mesopotamia, realized that they must have efficient means of communication if they were to consolidate their conquests and subdue the various countries. Roman roads were well constructed, for the Romans possessed all the elements of



GROWTH OF ROAD PASSENGER TRANSPORT

1. Shillibeer's omnibus of 1829. 2. "Knife-board" type horse tramcar (1879). 3. "Knifeboard" omnibus of 1880. 4. "Garden seat" type horse bus (1890). 5. "B" type bus on service in October, 1920. 6. Modern trolley bus in service in Nottingham. 7. "Feltham" type tramcar. 8. "STL" type bus.

Photos: London Passenger Transport Board; Leyland Motors

amazes travellers to observe what heavy and miscellaneous loads can be carried by an individual. After man's burden came pack animals, and this mode of transport still exists to-day in many countries of the world. Caravan routes through the desert mean the roadways for camel trains (so-called) and pack mules and horses. In mountain warfare, pack animals are used for the transport of light gun units, stores, etc.; while in Polar expeditions, dogs are used both as pack animals and for the hauling of sledges. Elephants are used in India in the haulage of logs and timber. It was early recognized that it was possible to move much heavier loads by haulage rather than

By the end of the seventeenth century, stage coaches had become a common sight on the roads. As roads were improved and the coaches made more comfortable and efficient, the speed gradually increased until sixty to eighty miles a day could be covered. Mail coaches were introduced in 1784, the first running to a set time-table between London and Bristol.

The first omnibus to be seen on the streets of London appeared in the year 1829. It was built and run by an Englishman named Shillibeer, and carried passengers in London between the Bank and Paddington at a fare of one shilling each passenger. In the 1850's tramcars were introduced, these being horse-



D. H. COMET MONOPLANE

In this plane Scott and Black won the air race to Australia, 1935

(Photo: Fox)

by carriage, the first evidence of this being the sledge, easily constructed of wood.

It is to the unknown creator of the wheel that we owe the greatest debt of gratitude. It is possible that the Chinese can take some credit for its evolution. In Britain the adoption of an efficient wheeled road vehicle was late in coming, due no doubt to the lack of good roads. In early times, London ladies preferred to travel in sedan chairs rather than be conveyed uncomfortably in springless wheeled carts. Earliest records show that a crudely constructed workmen's cart and a sort of hammock slung between four heavy wooden wheels were practically the only types of road vehicles until the introduction of coaches in the thirteenth century. In the original type of coach, as used during Elizabeth's reign, there was little comfort, there being no springs on the vehicle, small protection from the weather for the passenger, and the driver had to ride on one of the horses. The first vehicles for hire appeared in London in the reign of Charles II, and so popular did these hackney carriages become that measures had to be taken to restrict their use, in order to reduce street congestion.

drawn. Liverpool was the first city in Great Britain to make use of them. Electric traction came to be the method of propulsion at the beginning of the present century. Since that time another improvement has taken place in the adoption in many cities of trackless trams or buses.

The advent of the internal combustion engine revolutionized road transport all over the world, and great progress and improvements have taken place in motor vehicles within the last fifty years. See MOTOR-CAR, MOTOR-CYCLE.

Railways. The growth of industry necessitated improvement in the means of transport if industry was to progress; this led to the invention and development of railways in place of the then existing system of pack-horses and low carrying-capacity vehicles. See RAILWAYS.

Progress in the Air. Since earliest times, men have been ambitious to fly in the air. The ancient Greeks tell of attempts made by adventurers, with the assistance of wings, to imitate the birds, generally without much success. In 1505 Leonardo da Vinci, a scientist and painter, who had made a study

of the flight of birds, designed the first aircraft. A Frenchman, M. Charles, next solved the lighter-than-air problem by realizing that hydrogen lodged in a casing of silk covered with a rubber solution would raise a weight into the air; thus the balloon came into being. Balloons, however, have not been a success or of any value as transport agencies.

Possibly the non-success of the balloon led to trials and research into the possibilities of airships. Names like Santos-Dumont, a South American, and Count Zeppelin, a German, are closely linked with airship development. Particularly in Germany, airship design has been the subject of much experiment, and the large German dirigibles are now important factors in transatlantic commerce. See **BALLOON**; **DIRIGIBLE**.

Much experiment and research on gliders by Lilienthal, the Wrights and others, combined with the improvement of the internal combustion engine, led to the evolution of the aeroplane, until, in under fifty years from the first successes, air routes girdle the globe. See **AEROPLANE**.

TRANSPORT, MINISTRY OF. A department of the British Government set up in 1919 by the Ministry of Transport Act, which had as its object the improvement of the means of, and facilities for, locomotion and transport. To the new Ministry were transferred from the various Government Departments their powers and duties in relation to railways, light railways, and tramways, canals, waterways, and inland navigation; harbours, docks, and piers; roads, bridges, and ferries, and the vehicles using them. The Minister has power—as yet unapplied—to establish and work transport services by land and water within Great Britain. He is responsible for the administration of the Road Traffic Acts, 1930 and 1934, and the Road and Rail Traffic Act, 1933, and for the work of the Electricity Commissioners and the Central Electricity Board. The Railway Rates Tribunal has been established by the Minister to control railway rates.

In 1936 the Minister of Transport was elevated to Cabinet rank.

TRANSUBSTANTIATION. A doctrine expressed in a canon of the Council of Trent (which see), which represents the belief of the Roman Catholic Church at the present time. It is expressed as follows—

"If anyone shall say that, in the most holy sacrament of the Eucharist, there remain the substances of bread and wine together with the body and blood of our Lord

Jesus Christ; and shall deny that wonderful and singular conversion of the whole substance of the bread into His body and of the wine into His blood, the species only of bread and wine remaining—which conversion the Catholic Church most fittingly calls *Transubstantiation*—let him be anathema." This doctrine is based upon a philosophical theory, derived from Aristotle and followed by the Scholastics. Things according to this teaching have "substance," an underlying reality, and "accidents" which are the condition of them perceivable by the senses. The "conversion" that takes place in the Eucharist is of the substance, which be-



MINE DUMPS IN THE TRANSVAAL

comes the Body and Blood of Christ. The "accidents" or "species," viz. the appearances of bread and wine, remain the same.

The doctrine of Transubstantiation is accepted by the Orthodox Eastern Churches.

TRANSVAAL, *trans vahl*'. A province of the Union of South Africa (which see). Area 110,450 sq. miles; European population, 815,537 (1936). The Bantu population, also counted in 1936, was then over 2,412,517. The province is mainly a stock-raising region, with over 4,000,000 sheep, 3,000,000 cattle, and 1,000,000 goats. A good deal of maize is also grown, especially in the wetter east. In the southern centre lies the Rand goldfield, centring on Johannesburg. Most of the gold is extracted from "reefs" at great depths. Here is normally produced about half the world's gold output every year. There is also some diamond production in the south-west and coal-mining at Vereeniging. Manufactures include iron

foundries, tobacco, and soap. JOHANNESBURG (European population 252,579) began in 1886 with a shed or two. PRETORIA (European population 68,441) is the seat of government. The Transvaal was settled by Cape Dutch in 1836-37; in 1877 it was annexed by Great Britain, but rebelled and secured self-government in 1880. After the South African War (which see) it became part of British South Africa, and in 1910 became a province of the Union.

TRANSYLVANIA. A province of Rumania, which is chiefly an upland area surrounded by mountain ranges. It has an area of 22,312 sq. miles. The population is 3,343,220 (1935), of whom many are Magyars, who resent being transferred from Hungary to Rumania. The basin or central part of Transylvania is fertile, with crops of wheat, vine, tobacco, flax, etc., and much pasturage. Industries are related to wool, leather, and tallow. There is much timber, and the mountains contain several minerals, including gold, silver, copper, lead, and iron. There are several large towns, the chief of which is Cluj or Kolozsvár, with a population of 99,457 (1935). Transylvania was the Roman province of Dacia, and was later overrun by Nordic tribes and in the eleventh century by Magyars. It passed to the Austrian Empire in 1849, and in 1868 became part of Hungary. It declared its independence in 1918, and in 1919 was annexed by Rumania.

TRAPEZIUM, *tra pee' i um*. A plane figure having four sides, none of which are parallel. A *trapezoid* has one set of sides parallel.

TRAPPISTS. A branch of the Cistercian order of monks, famed for the austerity of its rules. This was introduced in 1664 by the abbot of La Trappe, a Cistercian monastery founded in Normandy in 1140. At the present time, Trappist monasteries are scattered throughout Europe, Asia, Africa, the United States, Canada, and China. There is a monastery on Caldey Island, Pembrokeshire. See RELIGIOUS ORDERS.

TRAV'ANCORE. An Indian native State under the rule of a Maharaja. It lies in the south-west of the peninsula bordering the Arabian Sea, and has an area of 7625 sq. miles and a population of 5,095,973 (1931). The interior is hilly and the coast low-lying. Rainfall is less than further north along the coast, but rice and other cereals grow abundantly. Tea is cultivated on the higher ground and there are various other crops. The people are mainly Dravidian. Two-thirds are Hindu and one-third Christian.

TRAVELLER'S CHEQUES. See CREDIT, LETTER OF.

TRAVERTINE, *trav' er tin*. A white or straw-coloured porous stone, formed from

the lime deposits of streams, lakes, and springs. It is a soft and spongy rock, easily worked when first quarried, but hardening afterward. Large deposits are found in many parts of Italy. It is the material that was used for the outside walls of numerous buildings of ancient and modern Rome, including St. Peter's and the Colosseum. It cannot be used as a building material in countries where the temperature falls below the freezing point, for the rock is porous and absorbs water, which would expand on freezing and cause the rock to disintegrate.

TRAWL. See NET.

TRAWLER. The name given to a motor- or steam-driven vessel designed and used for fishing with the trawl. The latter is an open-mouthed net which is towed over the sea floor by the ship.

TREACLE. See MOLASSES.

TREADMILL. A machine formerly often used in prisons, in some countries, where it was operated by convicts sentenced to hard labour. It consisted of a large, wide, and heavy revolving wheel with steps around



TREADWHEEL

The Japanese workman is preparing rice plants.

Photo: Fox

the circumference and a handrail above. When the criminals were placed on the steps, the weight of the men started the wheel to revolve. To keep their balance, they were forced to grasp the rail and tread the mill so long as the machine was in motion. The power produced could be used for grinding corn or for other similar purposes.

The *treadwheel* is still much in use in the East for irrigation (which see).

TREASON, *tre' z'n*. In a broad sense, treachery, breach of faith, or the betrayal of any trust. In its legal application, it is a serious breach of allegiance to a government,

committed by a citizen or subject, or by one under its protection; as such, it is the greatest crime known to the law, as attacking the safety of a sovereign State or its Head.

The British law of treason is based upon the Statute of Treasons, passed in 1351, during the reign of Edward III. Under this statute the following acts are declared to be treason—

1. "Compassing or imagining" (i.e. contriving or plotting) the death of the King, the Queen or their eldest son.

2. Violating the chastity of "the King's companion" (i.e. the Queen-Consort) or the King's eldest daughter unmarried or the wife of the King's eldest son.

3. Levying war against the King in his realm.

4. Adhering to the King's enemies in his realm by giving them aid or comfort in the realm or elsewhere.

5. Counterfeiting the King's seal or money, or importing false money.

6. Slaying the King's Chancellor or Treasurer, or any of the King's judges when sitting in Court.

The punishment for treason is now hanging or (if the King so directs) beheading, but it is unlikely that a convicted traitor would now be beheaded.

Only three cases of treason have been tried in England in the present century, namely, the cases of Lynch (1902), Ahlers (1914) and Roger Casement (1916).

Treason-felony. An offence, or group of offences, constituted by an Act of 1848, for which the maximum punishment is penal servitude for life. Treason-felony covers very much the same ground as treason, and the principal purpose of the Act is to provide an alternative to the death penalty.

TREASURE TROVE. Any gold or silver, whether in bullion, coin or plate, which has been concealed in the earth or in any building, and is later discovered in such circumstances that it is impossible to say who is the rightful owner of it. Gold or silver so discovered belongs to the King, who, however, as an act of grace, usually returns it to the finder or pays him the full value of it instead. When any treasure is discovered it is the duty of the coroner for the district to summon a jury and hold an inquest upon it. The jury have to decide who was the finder of the treasure.

TREASURY BILL. A device for short-term borrowing adopted by the British Government under the authority of an Act of 1877. The bill itself acknowledges money lent for a period of three, six, or twelve months, repayable at the face value. When funds are required, tenders for Treasury Bills are invited through the Bank of England, the price offered being something below face

value, the difference representing interest on the sum offered for the period the bill has to run. Bills are payable to bearer.

TREASURY, HIS MAJESTY'S. A department of the British Government responsible for the finances of the country and exercising control over the management, collection, and expenditure of the public revenue. Usually the Prime Minister takes the office of First Lord of the Treasury, but the real political head of the department is the Chancellor of the Exchequer.

TREASURY NOTES. See MONEY.

TREATY. A contract entered into between two or more sovereign States and intended to establish legal obligations binding upon them. A number of synonyms for "treaty" are used, e.g. "act," "pact," "convention," "protocol," "covenant," "declaration." Only sovereign States have the power of making treaties. States possessing a limited degree of sovereignty have a limited power of making treaties; thus the individual Cantons of Switzerland have power to make treaties with respect to certain matters, while on other matters this power is reserved to the Federal Government. No special form or procedure is necessary for the making of a treaty; it may be made even by word of mouth or by an interchange of letters or notes. Usually, however, treaties are embodied in a formal document signed by the representatives of the contracting Powers.

Ratification. Treaties are usually negotiated by representatives of the States concerned, who for this purpose are given "full powers" to negotiate and sign the treaty on behalf of their Governments. Nevertheless, it is a well-settled principle of International Law that a State is not bound by a treaty signed by its representatives until the treaty has been duly ratified according to the laws of that State.

See INTERNATIONAL LAW.

TREATY PORTS. A number of port cities in China through which commerce is carried on with foreign countries, under treaty provisions.

Prior to 1842, trade with China was conducted without government permission or protection. In that year, a treaty was entered into by Great Britain and China, providing that five ports, Canton, Amoy, Fu-chau, Ningpo and Shanghai, should be open to foreign trade. Since that time, similar treaties have been made with other nations, and to-day there are about forty-five treaty ports and a number of commercial ports in China (which see).

The major part of this trade is carried on with Great Britain, Germany, France, Japan, the United States, India, and Russia.

TREBIZOND. *treb' izond.* See TURKEY.

TREBLE. The highest of the parts in harmonized music. *Treble clef* is the term applied to the character used in designating the treble staff.

TREE. The thick, woody, self-supporting stem of a tree differentiates it from other kinds of plants.

Trees are divided into two general classes, according to the plan of the bole. In those of the first class, the bole extends the entire length of the tree without division, as in the pine, fir, and hemlock, among the evergreens; and (often) the beech, among deciduous trees. In trees of the other plan, the bole divides into branches, forming a large crown, as seen in the elm, oak, and maple.

The Age of Trees. Each year the hardwood or the softwood tree records its age by adding a layer of new wood to its bole and branches. When the bole of one of these trees is cut across and the surface made smooth, these rings can be

counted. Though the tree grows as long as it lives, it grows more slowly after reaching maturity. The oak, for example, reaches maturity in 120 to 200 years; after that, the annual layers of wood are very thin.

Trees are subject, like other plants, to the attacks of insects and to the effects of fungi and bacteria. Considerable damage is done to standing timber by wood-rotting fungi, some of which cause young wood and



LIME IN WINTER

Photo: E. J. Hoshing

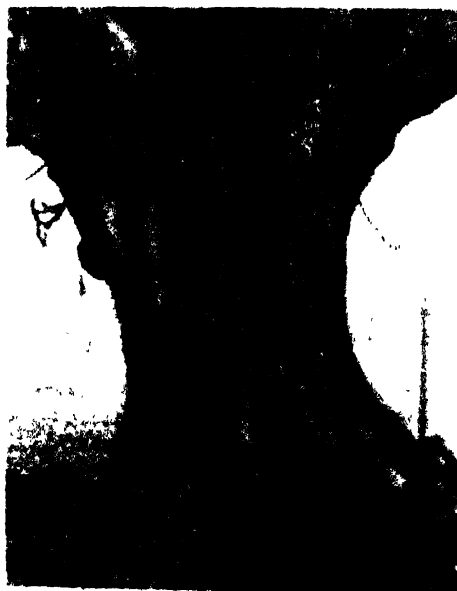
eventually whole branches to decay, and some of which affect the heart-wood.

TREE-CREEPER. A small bird, species of which are found in Europe (including



RED IRON BARK TREE IN NEW SOUTH WALES

Photo: Australian Trade Publicity



HORNBEAM BOLE

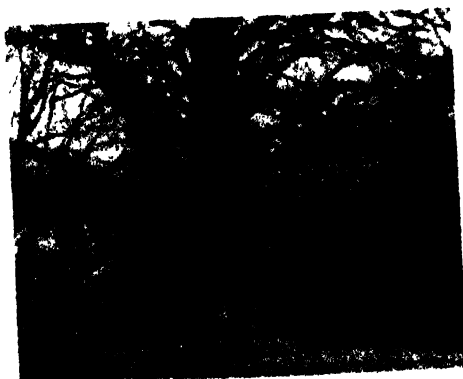
Photo: E. J. Hoshing



BAOBAB TREE AT MOMBASA
 Note the size in relation to the man.
Photo: Cherry Kearton



HAWTHORN IN WINTER
Photo. E J Hosking



OAK IN WINTER



ANCIENT BEECH TREE
 It is at Bolderwood in the New Forest
Photo Frith

Britain), Asia, and North America. Its colour, a drab brown spotted with white and buff, makes it inconspicuous. The underside is white. The food consists of grubs and insects which lie in the cracks of the bark of tree-trunks, up which the bird climbs with a characteristic jerky movement.

Scientific Name. The tree-creeper belongs to the family *Certhiidae*. It is *Certhia familiaris*.

TREE FROG, or TREE TOAD. A small tree-dwelling frog. The toes of tree frogs have soft pads on the tips, which act like suckers and help them to cling to smooth



TREE FROG.
Photo: U. & U.

bark. Most of the tree frogs have the power to change colour through a range of greyish-browns and greens, according to the colour of their surroundings.

TREE OF LIFE. See ARBOR VITAE.

TREFOIL, BIRD'S-FOOT. There are many varieties of bird's-foot trefoil. The flowers of all are yellow, more or less tinged with red and—as are those of all members of this family—papilionaceous (butterfly-like). They are borne in loose terminal clusters on thin weak stems. The leaves are opposite, comparatively long and narrow, and rounded at the tip.

Scientific Name. The bird's-foot trefoil belongs to the family *Leguminosae*. The common variety is *Lotus corniculatus*.

TRENCHARD, HUGH MONTAGUE, 1ST VISCOUNT (born 1873), Marshal of the Royal Air Force. He was educated at Eton and entered the Army in 1893, serving with distinction in the South African War and as Major-General in the World War. Created a baron in 1930, he became in the following year Commissioner of the Metropolitan Police

and introduced many important reforms, including the mechanization of the force by the provision of fast motor-cars, wireless appliances, and other aids to the suppression of crime. In addition he brought into existence the Police College at Hendon for the higher training of officers. In 1935 Lord Trenchard took over the supreme command of the Royal Air Force and in 1936 was created a Viscount.

TRENGGANU, *tren gah' nu*. An unfederated Malay state, ruled by a Sultan with the help of a British adviser. It lies on the east of the Malay peninsula and has an area of about 5000 sq. miles. Much is densely forested, but there is native cultivation of rice and other crops. Rubber, copra, tin, iron and manganese ores are exported. The population is estimated at 189,000 (1935). The capital is Kuala Trengganu.

TRENT, COUNCIL OF. After the development of the Protestant Reformation, Roman Catholic authorities felt the need of a great council for the restatement of the fundamental doctrines of the Church. After many delays, a council was called at Trent, a city of the Austrian Tyrol, in December, 1545, by Pope Paul III. Wars and religious disturbances also interrupted the sittings, and the work of the Council of Trent was not completed until 1563, when its decrees were confirmed by Pope Pius IV. The result of the Council was a reaffirmation of Roman Catholic doctrines, and its decrees are at the present time regarded as authoritative statements of Roman Catholic creed and practice. Many abuses were suppressed, the organization of the Catholic Church was improved, and various disputes were ended. These changes strengthened the Church and were largely responsible for the great Catholic movement known as the Counter-Reformation.

TRENTINO, *tren te' no*. See TYROL.

TRENT, RIVER. See LINCOLNSHIRE; NOTTINGHAMSHIRE; DERBYSHIRE.

TREPANG' (the Malay *tripang*). The commercial name for the dried bodies of certain species of marine animals commonly called *sea cucumbers* (which see). An active trade in trepang is carried on in the East Indies. Preparation for the market includes removal of the internal parts, boiling of the bodies, soaking them in fresh water, and smoking or drying them in the sun. The product of these processes is a rubber-like substance, which is used to thicken soups. Large quantities are exported yearly to China.

TREPANING, *tre pan' ing*, or TREPHINING, *tre fi' ning*. These terms are applied to the surgical operation of making a small perforation in the skull, and they also refer to the instruments used. A trepan is a small cylinder with sharp cutting teeth on the

edge. A trephine is an improved form of trepan. It has a handle placed horizontally, like that of a gimlet, and a sharp steel centre pin, which projects slightly below the edge of the cylinder. The pin, when fixed on the part of the bone to be opened, forms an axis for the rotating edge of the instrument. The pin is removed when a sufficiently deep groove has been cut for the instrument to work steadily. The trepan makes complete revolutions, but the trephine operates through semicircular movements to the right and left. Usually, an opening less than an inch in diameter is made. The operation is used in cases of skull fracture and removal of tumours. See SURGERY.

TRESPASS. In general, as the word is used for instance in the Lord's Prayer, a trespass is any act of wrongdoing. In law it has a narrower meaning. Trespass is one of the oldest terms in English law and originally signified any kind of violent injury, either to person or to property. In modern English law, however trespass is the act of infringing the rights of an owner of land, either by entering upon it without permission, or by remaining on it after permission to remain has been withdrawn, or by throwing or placing something on it without authority. Trespass is not a criminal offence, so that the familiar notice "Trespassers will be prosecuted" is usually an empty threat; but a trespasser who does any damage may be prosecuted for "malicious damage to property."

TRIAL. See COURTS, CRIME (Criminal Procedure), EVIDENCE; JUDGE, JURY, MAGISTRATE, PROCEDURE, LEGAL.

TRIANGLE. Name given to a plane figure having three straight sides and hence three corners, each of which is called a *vertex* (plural, *vertices*). Triangles are classified according to their sides and according to their angles. One whose three sides are equal is an *equilateral* triangle; one which has two sides equal is an *isosceles* triangle, one that has no two sides equal is a *scalene* triangle. A triangle that has a right angle is a *right* triangle; one that has an obtuse angle is an *obtuse* triangle, one that has all its angles acute is an *acute* triangle. Any side of a triangle may be called the *base*. The distance from any vertex to the opposite side is called an *altitude*. In a right triangle, the side opposite the right angle is called the *hypotenuse*.

TRIANON, *tre an noN'*, TREATY OF. The treaty of peace concluded between the Allies and Hungary following the World War, was signed in the gallery of the Grand Trianon at Versailles, 4th June, 1920. The Treaty of Trianon drastically limited Hungarian territory, reduced its population

by more than 7,500,000, alienated about 3,000,000 Magyars (which see), and left the country landlocked.

Hungary was compelled to recognize the territorial changes already made in settling the frontiers of Austria, Czechoslovakia, Yugoslavia, and Rumania, and to forfeit all claim to Fiume. The military and reparation clauses were similar to those in the Treaty of Saint-Germain, except that Hungary was allowed an army of 35,000. The latter clause was repudiated in 1936. The Treaty has created almost as many problems as it solved, resulting in an ardent "revisionist" movement.

TRIAS'SIC PERIOD. The earliest period of the Mesozoic Age, succeeding the Permian and succeeded by the Jurassic Period. It was named from its threefold development in Germany, where it was first carefully studied. In England and other parts of Western Europe, the Triassic rocks consist of conglomerate, sandstone, shale or marl and are largely land or fresh-water deposits, resembling the Permian rocks. In regions where the two systems lie in conformable sequence, they are almost indistinguishable. In South-eastern Europe and South-western Asia, the Triassic strata, which there are largely marine limestones, reach a great thickness.

The Triassic Period was characterized by the abundance in the sea of cephalopod molluscs with coiled shells, known as ammonites, and by the dominance on land of reptiles, especially huge lizards. Remains of what may have been the earliest mammals are also found. The plant life was marked by the development of cycads and of coniferous trees. See GEOLOGY.

TRIBONIAN. See JUSTINIAN.

TRIBUNE, *trib' une*. The name given in ancient Rome to either of two officers whose functions were dissimilar.

The **Military Tribunes** were originally the leaders of the soldiers furnished by the various tribes. During the time of the republic, there were six tribunes to each legion, and they ranked next after the commander-in-chief. At first they were appointed by the consuls, but later part or all of them were elected by the people.

Tribunes of the People were magistrates elected to protect the rights of the plebeians. In 494 B.C. this class "seceded" from Rome and refused to return until permission was given to choose such officers (see ROME). At first there were probably only two tribunes, but later their number was increased to five, and at last to ten; they held office for one year only, but were eligible for re-election. The tribunes might veto any measure proposed by the Senate.

TRICEPS, *tri seps*. See BICEPS, MUSCLES

TRICHINA, *tri kī' na*. An animal parasite which, when it finds lodgment in the human system, causes a serious disease known as *trichinosis*. The trichina is a minute worm which inhabits the muscles of pigs, rabbits, rats, and other animals. In these creatures, it exists as an undeveloped, hairlike organism, coiled up in an enclosing sheath, or cyst, and it does not develop beyond this immature stage until it is taken into the human intestine. Human beings usually acquire trichinosis through eating uncooked or poorly cooked pork from infected pigs; this is known as *measly pork*. As the meat is digested, the immature worms are freed from their cysts, and in two or three days reach maturity. About eight days later, the females, having penetrated the intestinal wall, give birth to fully developed larvae in very large numbers. The larvae pass through the intestinal wall and are carried by the blood-vessels to the muscles, where they find lodgment. While in the muscle fibres, they increase greatly in size, and become encysted

TRICLINIC, *tri kīn' ik*, **SYSTEM**. See CRYSTALLIZATION.

TRICUSPID, *tri kus' pid*, **VALVE**. See HEART.

TRIESTE, *tre es' tē*. See ITALY.

TRIGGER FISH. More generally known as the "File Fish" and belonging to a group seldom found outside tropical waters, the Trigger fish has a deep-keeled but thin body ornamented by the curious spiny dorsal fin from which it takes its name. This fin



TRIGGER FISH
Photo Weller

bears two long spines, the foremost of which is rough and file-like. When laid flat to the back this spine engages in a hollow in its neighbour and cannot be released without movement of the second spine. There are several species in this family and specimens are occasionally brought to British coasts by the drift of ocean currents.

Scientific Name. *Balistes maculatus*.

TRIGLYCERIDS, *tri glis' er idz*. See BIOCHEMISTRY.

TRIGONOMETRY, *trig on om' et re*. A branch of mathematics concerned with the measurement of triangles and with the



TRICHINA SPIRALIS
Encysted in muscle, magnified 150 diameters.
Photo Visual Education Service

relations of their sides and angles to one another. The two chief divisions of trigonometry are *plane* and *spherical*. Plane trigonometry treats of such triangles as lie wholly in a plane, and spherical trigonometry of triangles that lie upon the surface of a sphere.

TRILLIUM. The names of several species of early-flowering bulbous plants belonging to the lily family. These have three sepals, three petals, six stamens and three styles, and each flower blossoms from a cluster of three leaves. The flowers are white, rose or purplish. The species is native to North America.

Scientific Name. Trilliums belong to the family *Liliaceae*. *T. grandiflorum* (white) is one of the best varieties for gardens.

TRILOBITE, *tri' lo bītē*. Fossil arthropods found only in Palaeozoic rocks. They first appear in the Cambrian, become abundant in the Silurian, and die out in Carboniferous and Permian rocks. The dorsal surface of the creature was covered with a calcareous shell, divided into three parts longitudinally and subdivided into the three parts known as the cephalic (head) shield, thoracic (body) shield and pygidium (tail) shield. The animal was able to roll itself up and thus protect the lower surface of its body, which was soft.

TRIM. The county and market town of County Meath, Irish Free State, about thirty miles from Dublin. It has a population of about 1500, and is served by the

Great Southern Railway. Beside its main street flows the River Boyne. It was once a walled city, and traces of the walls remain as does the old Sheep Gate on the river bank. The town gets its name from the ford across

the precincts of the town, is still marked by the "Yellow Steeple." At Newtown, on the outskirts of the town, are the ruins of the Priory for Canons Regular of the Congregation of St. Victor. Trim is an agricultural centre, but in recent years some industries have been introduced.

TRINCOMALEE'. See CEYLON.

TRINIDAD. The second largest island of the British West Indies, famous as the source of most of the world's supply of asphalt. It lies 6 miles east of the coast of Venezuela, near the mouths of the Orinoco River. It is 1862 sq. miles in area. In the north and south, there are ranges of hills covered to the top with dense forests. The most striking natural feature, excepting Pitch Lake, the asphalt lake (114 acres), is Maracas Falls, 312 ft. high.

Trinidad is a British Crown Colony, with the seat of government at Port of Spain, a town with a population of 73,624. The population of the island is 405,517 (1934). About a third of the people are East Indians, whose emigration from India has been encouraged by the government. The upper classes are creoles of British, French, and Spanish blood, the rest are negroes. English is the language generally spoken in the towns. Education is provided chiefly through state schools, although several religious denominations have established schools and colleges. In 1921 the Imperial College of Tropical Agriculture was instituted to train farm superintendents, planters, and specialists in tropical agriculture.

In 1498, on his third voyage to the New World, Columbus vowed to name the first land he sighted after the Trinity, and in this way Trinidad was named. Spain made no attempt to colonize the island. Britain acquired the island by treaty in 1802. The natural resources have made it a valuable colony, asphalt, which for many years was the main export, has been far overshadowed by petroleum. Trinidad is now the chief producer of mineral oil in the British Empire with an output of 11,000,000 barrels of crude oil (1934). There are several refineries. Large quantities of tropical products are exported, namely, cocoa, sugar, rum, molasses, coffee, coconuts, rubber, etc.

There is a governor and a partly-elected legislative council. Tobago is included in the same administration.

TRINITROTOLUOL, *trī nī tro tol' ū ol*, OR **T.N.T.** See EXPLOSIVES.

TRINITY. The conception of God as one in nature and yet as having a threefold personality, Father, Son, and Holy Spirit. The doctrine is a development of Christian theology, not being taught in the Old Testament, but capable of being deduced from passages



TRINIDAD

1. The Red House (Law Courts and Government Offices). 2. Native policeman. 3. Native labourer with machete. 4. Coastal scenery.

Photos: Fox, Tropical; George Long

the river *Ath Truim*, "the ford of the elder bushes." King John's Castle, in the town, is a fine specimen of Anglo-Norman architecture. It was founded about 1170 by Hugh de Lacy. Trim was also the site of a Mint established in 1450 by Richard, Duke of York. St. Mary's Abbey, within

in the New Testament. The first authoritative statement of belief in Father, Son, and Holy Spirit was made by the earliest general council of the church held at Nicaea in A.D. 325, which also declared the Son to be of equal substance with the Father. With regard to the Holy Spirit, the East and West subsequently divided, the Eastern Church holding procession of the Spirit from the Father through the Son, and the West procession alike from Father and Son. The doctrine of the three in one is considered to be a mystery that man cannot explain.

TRINITY HOUSE. The Corporation of the Holy and Undivided Trinity was chartered by Henry VIII in 1514, but an institution had been in existence for many years, possibly as far back as the days of Alfred the Great. Henry VIII's purpose was that the Corporation should improve the status of British shipping, but later other duties were entrusted to the body. It is now the General Lighthouse and Pilotage Authority in England and Wales with certain jurisdiction in Scotland, Ireland, the Channel Islands and Gibraltar. Thirteen Acting Elder Brethren are elected from the Royal Navy and the Merchant Service. These act as assessors in the Admiralty Division of the High Court. The thirteen honorary elder brethren are elected from distinguished personages, the office being considered a high honour.

TRINITY SUNDAY. The Sunday after Pentecost, or Whitsunday, sacred to the celebration of the Trinity, and introduced into the Church calendar by Pope John XXII (1316-1334).

TRIPE. A meat consisting of part of the muscular walls of the stomach of sheep or cattle.

TRIP HAMMER. A power hammer used principally in such forgings as do not require the heavy blows of a steam hammer. The hammer is raised by the action of a revolving cylinder with cams, and is released when it has reached the highest point within the range of lift of the cams, falling by its own weight. Its stroke, unlike the action of the steam hammer, cannot be controlled.

A form of speech, commonly heard, refers to *trip-hammer blows*, meaning that the blows are delivered with every ounce of force available.

TRIPLE ALLIANCE. The first treaty of this kind was signed in 1668 by England, Holland, and Sweden, to prevent Louis XIV of France from taking possession of the Low Countries (now Holland and Belgium). Another alliance, for the purpose of checking the power of Spain, was made in 1717 between Great Britain, France, and Holland.

Triple Alliance of 1882. In that year,

Germany, Austria-Hungary, and Italy allied themselves by treaty. Italy had never become reconciled to the Austrian possession of the former Italian provinces, Trieste and Istria—"Unredeemed Italy." However, Italy's quarrel with France was of more recent date, for France in 1881 had taken Tunis, a territory which Italy had long coveted as a colonial possession. Furthermore, the newly united Italian state was conscious of domestic weakness and sought the support of a strong militaristic monarchy. Alliance with Prussia had won Venetia for Italy in 1866. Hence Italy decided, as a matter of expediency, to join Austria and Germany, rather than be left out entirely in a game for which the powers were obviously choosing sides.

The Alliance was broken by Italy in 1915, when that country not only refused to aid Austria and Germany in the World War, but declared war upon Austria in 1915 and upon Germany in 1916. See **TRIPLE ENTENTE**; **WORLD WAR**.

TRIPLE ENTENTE, *ahn lahnt'*. The French term for "triple agreement." The outbreak of the World War in 1914 found the chief powers in Europe divided into two opposing groups—the Triple Alliance, consisting of Germany, Austria-Hungary, and Italy; and the Triple Entente, composed of England, France, and Russia. The Triple Alliance had been formed in 1882, and, to offset its influence, France and Russia had concluded a dual alliance in 1895. In 1904 England settled outstanding differences with France, and in 1907 came to an understanding with Russia about their respective policies in Persia, Afghanistan, Tibet, and other regions where their interests conflicted. These arrangements resulted in the formation of the Triple Entente. See **TRIPLE ALLIANCE**; **WORLD WAR**.

TRIPOLI, *trip' ol i*. The easternmost of the Barbary states of the former Turkish domain, and now one of the four provinces of Italian Libya (which see). It is also the name of the chief town of the province with a population of 91,000 (1934). See **BARBARY STATES**.

TRIPOLI. A mineral resembling clay or chalk, composed chiefly of minute siliceous skeletons of microscopic plants called diatoms, which are so hard that they will scratch glass. Thick deposits of tripoli are sometimes found under peat beds. When ground to a fine powder, tripoli is used for polishing glass, metals, and marbles. It takes its name from the fact that it was originally brought from Tripoli in Africa. It is found in France, Italy, Germany, Nova Scotia, and America. See **KIESELGUHR**.

TRIPOS. See **CAMBRIDGE UNIVERSITY**.

TRIREME, *tri' reem*. An ancient war vessel, or galley, invented by the Corin-

thians. It is generally accepted that the vessel was propelled by three banks of oarsmen. See GALLEY.



TRIREME

Relief from Athens showing oarsmen in a trireme. The two lower banks of oars project from portholes, the top bank from the gunwale.

Photo. British Museum

Derivation. The word *trireme* is derived from the Latin *tres*, "three," and *remus*, "oar."

TRISTAN DA CUNHA, *hoon' ya*. A volcanic island in the South Atlantic in lat. 37° S., long. 12° W. The habitable area is only 12 sq. miles. Bullocks and sheep are



A DWELLING ON TRISTAN DA CUNHA

Photo. Fox

reared and potatoes are grown. Fish is plentiful. The population of 163 is descended mainly from families left behind when the small British garrison was withdrawn in 1817. The island is British but self-governed. Attached to the island are the outlying uninhabited Inaccessible, Nightingale, and Gough Islands.

TRITOMA, *tri tū' ma*, or **KNIPOFIA**. A popular herbaceous plant also called *Red-Hot Poker*, which flowers from August into early autumn. The leafless stem is thick and sturdy and grows up to 6 ft. high. The

small flowers, yellow-red, are thickly clustered for some inches at the end.

TRITON, *tri' tōn*. In Greek mythology, the son of Poseidon and Amphitrite. Ancient poets wrote of "tritons" as minor sea deities.

TRIUMPH, *tri' umf*. A word of uncertain origin, but probably derived from the Greek *thriambos*, the name given to a procession in honour of the god Dionysus. In ancient Rome, a triumph was the highest honour that could be bestowed on a general on his return from a successful campaign.

TRIUMVIRATE, *tri' um' vi rayt*. The term applied in Roman history to a body of three men associated in seizing the government and sharing its rule. The famous First Triumvirate, 60 B.C., composed of Caesar, Pompey, and Crassus, was the first instance of such rule, though it existed without legisla-

tive sanction. The Second Triumvirate, 43 B.C., was formed under a special enactment by Octavius (Augustus), Lepidus, and Mark Antony.

TROCHAIC, *tro kay' ik*, **METRE**. See METRE.

TROGLODYTES, *trog' lo dītes*. A name meaning "cave-dwellers," given by the ancient Greeks to a tribe or race who dwelt in caverns or holes which they dug for themselves in the ground. They herded cattle and were hunters and sometimes robbers. They are mentioned in the works of Herodotus, Strabo, and Aristotle, and were employed in the invading army of Xerxes.

TROGON, *trō' gon*. A family of birds found in warm regions, noted for their beautiful plumage. They have a peculiar foot structure, as the first and second toes are reversed. The bill is short and strong, the tail usually elongated, and the feet are small.



TRITON

Photo. Victoria and Albert Museum

and weak. One of the most interesting and brilliantly coloured of the group is the Central American *quetzal* (which see).

Scientific Name. Trogons constitute the family *Trogonidae*. There are about fifty species.

TROLLOPE, ANTHONY (1815-1882). An English civil servant who in middle life turned to novel-writing, and whose fame rests chiefly on his stories of contemporary English life and manners. Trollope was



ANTHONY TROLLOPE
Photo: Herring Bros

born in London. He passed an unhappy boyhood and was poorly educated; at 19 he entered the postal service. He began writing fiction in 1847, but it was not until 1855, when *The Warden* was published, that he won recognition as a novelist of merit.

Trollope is at his best when he portrays the life and society of English cathedral towns, in

novels such as *The Warden*, *Barchester Towers*, *Doctor Thorne*, *Framley Parsonage*, *The Last Chronicle of Barset* and others, the whole series being grouped under the title *Chronicles of Barsetshire*. The reality of his characterization outweighs faults of triviality and repetition.

He also wrote many other novels, a monograph on Thackeray, travel, sketches, and an interesting *Autobiography* (1883).

TROMBONE. One of a family of brass instruments, used in orchestras and military bands because of the volume, depth, and richness of the notes. It consists of a tube twice bent, ending in a trumpet-shaped bell, and sounded by means of a cup-shaped mouthpiece and a slide mechanism. By



TROMBONE

manipulation of the slide, the air tube is altered in length, and the pitch of the natural harmonics is accordingly varied from the fundamental. The instrument is at its highest pitch when the slide is closed. Like the violin, the trombone has a complete chromatic scale. There are four sizes, called *alto*, *tenor*, *bass*, and *contrabass*. In a later type of instrument, there are valves instead of the slide mechanism.

TROMP. The name of two Dutch admirals. **MARTIN HARPERTZOOM TROMP** (1597-1653), was born in Brielle, Holland. His father was captain of a merchantman, and Martin went to sea with him when 8 years old. He was subsequently captured by Moslem pirates, but escaped several years later. In 1637, Tromp attained the rank of vice-admiral, and two years later won a brilliant victory over the Spanish fleet off Gravelines. On his return to Holland Tromp was made admiral.

In the war of 1652, Tromp controlled the English Channel for about three months. When, in February, 1653, Tromp left Holland with a convoy of richly laden merchantmen, Blake attacked him. Tromp kept up a gallant running fight and managed to bring many merchantmen safely to Holland.

Again, in June of the same year, the two fleets met, but the Dutch vessels, poorly equipped, were no match for the enemy, and sought refuge in the Texel. Once more, however, Holland got together an inferior fleet (composed mostly of converted merchantmen), and Tromp broke the English blockade, but twenty-four of his ships having deserted, the British won the victory. In this battle, Tromp was mortally wounded.

CORNELIUS VAN TROMP (1629-91), son of the preceding, was defeated in the Battle of Solebay (1665) and was for a time deprived of his command. Reinstated in 1672, in the following year he fought a brilliant action against the English and the French.

TROMSÖ. See NORWAY.

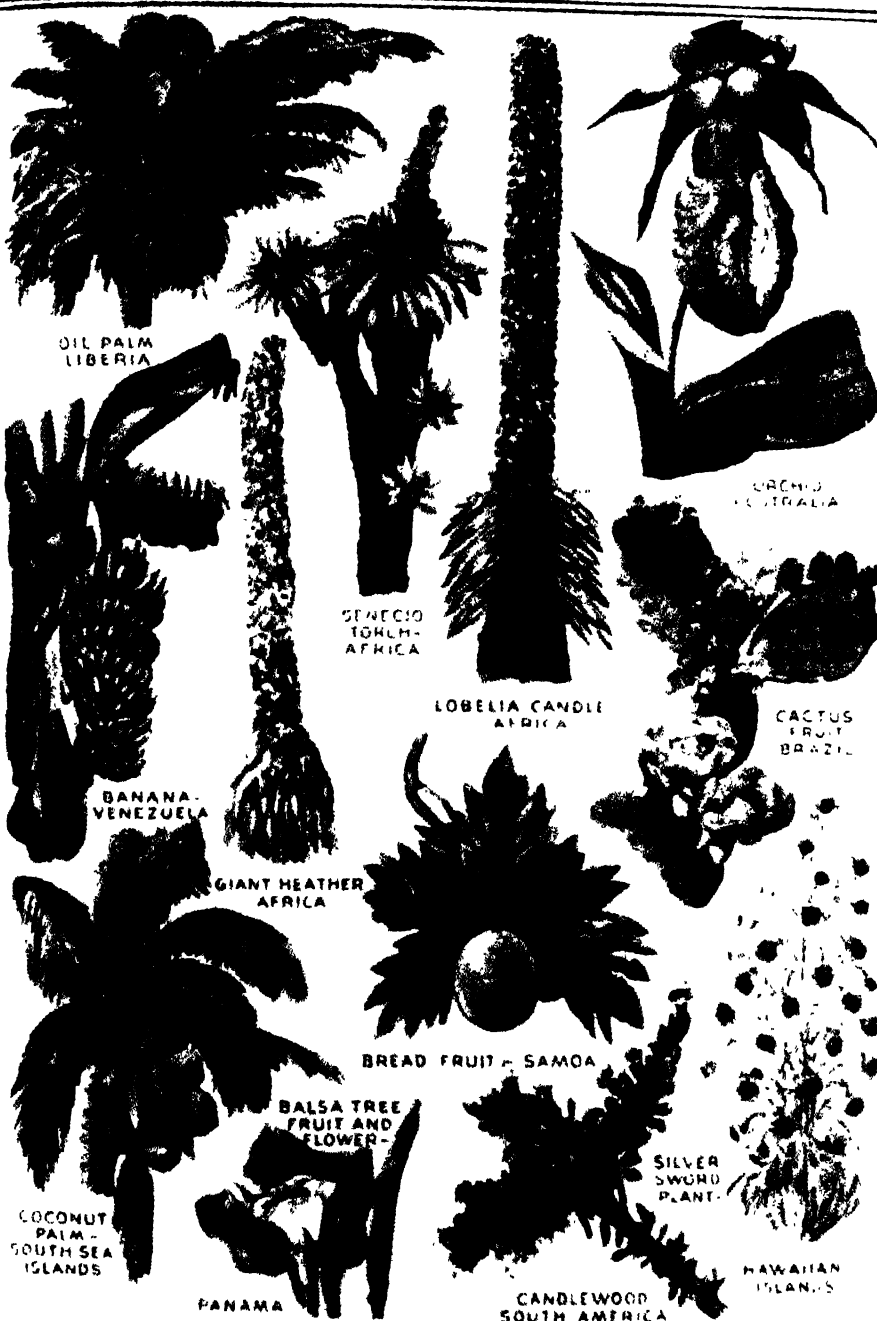
TRONDHEIM. See NORWAY.

TROPIC BIRD OR BOATSWAIN. A bird which is found only in tropic waters. It dives perpendicularly for fish, in the manner of terns, but is distinguished from them by its very long central tail feathers. Its plumage is pure white or pinkish in colour, and of a remarkably soft, satiny appearance. The best-known species is the *red-billed tropic bird*, which occurs accidentally as far north as Newfoundland. It is pure white, with a coral-red bill, and is nearly 40 in. in length, the tail being 20 in. Other species are the *yellow-billed* and the *red-tailed*. All tropic birds nest in colonies, making their homes in holes, in crevices in the rocks, or on the bare sand. The one egg is whitish or brownish, mottled with dark brown.

Scientific Names. The tropic birds belong to the family *Phaethontidae*. The red-billed is *Phaethon aethereus*; the yellow-billed *P. flammaris*, the red-tailed, *P. rubicanda*.

TROPICS. In astronomy, two small circles on the celestial sphere, lying parallel with the celestial equator and distant from it twenty-three and one-half degrees each.

MARVELS *of the* TROPICS



They mark the seeming limits of the sun's journeys north and south of the equator. The northern one touches the ecliptic at the zodiacal sign Cancer, and is accordingly called the Tropic of Cancer; the southern tropic is called Capricorn for a like reason.

These two parallels of latitude mark the extreme southerly and northerly points on the earth's surface at which the sun can be directly overhead, but only approximately is the intertropical area, or Torrid Zone of the ancients, the hottest area of the earth's surface. See ZONE.

TROSSACHS (Gaelic "rough country"). A picturesque wooded glen, part of a narrow valley in which lie Loch Katrine and Loch Achray, and forming a neck of land between the two lakes. The craggy Ben Venue lies to the south-west, the wooded slopes of Ben A'an rise on the north. The district is often called an epitome of Scottish landscape, and being easily accessible, has become increasingly popular with tourists since first familiarized by Scott in *The Lady of the Lake* and *Rob Roy*.

TROTZKY, LEON (born 1879). Real name LEV DAVIDOVICH BRONSTEIN, a Russian Jew, born near Elizavetgrad and educated at Odessa. Imbued with revolutionary ideas from childhood, before he was 20 years old he was arrested and banished to Siberia.

Forging a passport with the fictitious name Trotsky, which he subsequently adopted, he managed to escape to England in 1902. Here he had for companions such zealous revolutionists as Plekhanov and Lenin. The Russian uprising of 1905 found him a prominent member of a St Petersburg Soviet. Again Trotsky was exiled to Siberia, but as



LEON TROTZKY

Photo: Brown Bros.

soon as he arrived there, he escaped. Trotsky was outspoken in his disapproval of the World War, and he was requested to leave France and Spain. Finally, he sought refuge in New York.

After the Tsar's downfall in 1917, Trotsky returned to Europe, was arrested in England and was released at the request of the Russian Provisional Government. He hurried to Russia, and eventually allied himself with Nikolai Lenin and the Bolsheviks. In July he was imprisoned by Kerensky, but on the Bolshevik triumph he became Minis-

ter of Foreign Affairs and later Minister of War. A commissioner to the Brest-Litovsk Treaty, he signed reluctantly at Lenin's insistence. The reorganization of the Army and the suppression of democratic disregard of orders were his work; he discouraged the shooting of Imperialist officers, whose technical knowledge he needed. For the failure of the war with Poland he cannot fairly be blamed.

After the death of Lenin early in 1924, Trotsky was deprived of power. The next year saw his return to Moscow, with modified authority. In 1927 the Soviet rulers, under inspiration of Stalin, expelled him from the Communist party. He had always been a devoted supporter of the Third International, eager to foment Communist action in all lands, and had become something of an embarrassment to Stalin, who sought to reopen trade relations with other powers. The following year, he was expelled from Russia and sent to Turkistan, and in 1929 to Constantinople. Unhappy in his Turkish environment, he made unsuccessful attempts to gain admission to Germany and England. After spending some years in France he settled in Norway where he enjoyed a large measure of freedom from interference until 1936, when, accused of fomenting sedition in Russia, that country successfully demanded his expulsion. He then found asylum in Mexico.

Trotsky has written several books and essays on political and social subjects. His works in English include *Defence of Terrorism*, 1917; *Lenin; Where Is Britain Going, Towards Socialism or Capitalism?* and *The History of the Russian Revolution*.

TROUBADOURS, *tru' bā dors*. Lyric poets who flourished in Southern France between the eleventh and the fourteenth centuries, the composers of charming love poems, expressed in the musical Provençal dialect. The term is applied either to the professional, who led a wandering life, travelling from court to court, or to the amateurs, among whom were kings and nobles. Some attached themselves to the households of their feudal lords. Those of the troubadours who could not sing taught their verses to professional musicians called *jongleurs* (which see).

TROUT. The premier sporting fish for the majority of anglers, the trout, of which there are several sub-species, haunts clear fresh-water lakes and rivers in temperate zones almost throughout the world. It is the subject of a considerable industry whereby millions of trout eggs, fry, and young of one or two years' growth are distributed for the restocking of depleted waters; and from England, the heart and centre of trout-fishing, it has been sent to rivers in

Africa, New Zealand and South America. The parent species, the sea trout, is a marine fish visiting fresh water usually only to reproduce its kind, and in this habit and in appearance it closely resembles the salmon (which see). It is, however, smaller than the salmon, as are almost all trouts. Trout



GIANT TROUT

These were caught with rod and line in Lake Minnewanka near Banff, Alberta, and weighed 20½ lb. (left) and 40½ lb.

Photo Canadian Pacific Railway

are unmistakable in appearance, their grace of line and beautiful markings being unrivalled among fresh-water fishes. As food the fish is superior and usually brings a high price

Scientific Name. *Salmo trutta*

TROUVÈRES, *troo vair'*. Medieval court poets, who were to the north of France what the troubadours were to the southern part of that country (see TROUBADOUR). The name comes from the French *trouver*, meaning "to find, or invent." Their poems were principally of an epic character, in contrast to the lyrics of the troubadours. The trouvères, who were often men of high rank or social position, occupied an important place in early French literature, and helped to develop the French characteristics of wit and refinement.

TROWBRIDGE (*trô-*) Urban District and market town of Wiltshire, situated on a tributary of the Avon, with an area of 2126 acres and a population of 12,011 in 1931. It has a long history which begins with its mention in Domesday Book, whilst the castle was one of the fortresses of the de Bohun family. Markets have been in existence since the reign of King John, but modern Trowbridge shows little signs of its antiquity. For a long period the town has been the administrative centre of the county of Wiltshire. It has a flourishing cloth and

weaving industry and is also engaged in brush-making, brickmaking, engineering and bacon curing.

TROY, OR ILIUM. An ancient city of Asia Minor, immortalized in the Greek epic, the *Iliad*. Recent excavation has shown the existence of an important city on this site, which flourished in the twelfth century B.C. Within historic times, about 700 B.C., the Greeks built a city, Ilium by name, on what they supposed was the site of the ruined city. Ruins of several cities, in fact, have been found buried, one beneath the other, on the traditional site of Troy. Archaeological research has further shown that there was an actual siege of Troy.

TROYES, *truwah*, TREATY OF (1420). See HENRY V OF ENGLAND.

TROY WEIGHT. A standard system used in weighing gold, silver, platinum, and coins, also jewels, except pearls and diamonds, which are weighed in carats, one carat being equal to 3.17 grams troy. Troy is derived from Troyes, an important commercial town of France in the fourteenth century. Like many other towns of that period, it had its own system of weights and measures, and the *pound of Troyes* became widely known. In the modern Troy weight the pound contains twelve ounces, the ounce equals twenty pennyweights, and the pennyweight equals twenty-four grains. The pound avoirdupois equals 7000 grains. See POUND.

TRUCK ACTS. A series of Acts of Parliament passed in the nineteenth century, the object of which is to prevent employers of labour from paying their workpeople in kind instead of in money. The Acts provide that a workman's entire wages must be actually paid to him "in the current coin of the realm", and any contract made by a workman to receive any part of his wages otherwise than in cash, or to spend his wages in any particular way or place, is illegal and void.

TRUMPET. Among the most ancient of wind instruments, the known history of the trumpet dates as far back as 2000 B.C. It is of brilliant and penetrating tone, and consists of a long, narrow tube, curved back upon itself twice, cylindrical in two thirds of its length, and conical in the remainder. The mouthpiece has the form of a shallow cup, and the other end is a flaring bell. Before the introduction of the modern valve trumpet, a full chromatic scale could not be obtained. Piston valves, each one of which controls a certain length of tubing, are a part of the mechanism of the trumpet used in modern orchestras and wind bands. Trumpets are made with crooks in *F* (most used), *E*, *E♭*, *B♭*, and *C*. The *C* trumpet produces notes of the written pitch, and the

others are transposing instruments. A slide trumpet has also been introduced, but it is difficult of intonation. Bach and his contemporaries wrote high and florid trumpet parts, unplayable on the modern trumpet and requiring the finer bore and smaller mouthpiece of the older trumpets.

Both the bugle and the trumpet are used to summon soldiers to their duties, and to convey commands of field officers, the trumpet being the special instrument of the cavalry. See BUGLE.

TRURO. Cathedral city of Cornwall, with an area of 1139 acres and a population of 11,074 in 1931. Although Bodmin is the assize town of the county, the county



TRURO

With the Cathedral, seen from the south-west

Photo Taylor

council offices are at Truro which is also the centre of its ecclesiastical and social activities. Its history beyond the reign of King Stephen, when it was granted a Charter, is doubtful, but the parish of Kenwyn, which is included in modern Truro, is frequently claimed as the site of the Roman station of Genon. The meaning of the name Truro is generally conceded to mean "town on the river," from the old Cornish, *Treveren*. In the Middle Ages it was a port of some distinction, but lost its supremacy with the phenomenal growth of Falmouth. To-day it is the principal market town for the surrounding district. As a cathedral city it has become a large and flourishing centre of tourist traffic.

TRUST. In economics a trust is an industrial monopoly—a large undertaking or amalgamation possessed of great power over a market. A trust may be said to exist when a person, firm, or combination owns or con-

trols enough of the plant producing a certain article to be able, for all practical purposes, to fix the price at which it shall be sold. Control over the price is the fundamental test of monopoly.

The Voting Trust. The term "trust" originated as a shortened form of *voting trust*, common in the United States until held to be illegal. Under the voting trust arrangement, the stockholders of the companies to be brought together assigned their stock to a board of trustees, who controlled the affairs of all the companies. The stockholders, in return for their stock, received trust certificates, which could be transferred like ordinary certificates of stock.

Modern Trusts. The next device resorted to for the purpose of restraining competition was the modern trust. This was sometimes brought into being through the medium of a holding company; that is, a company formed to acquire at least a majority of the voting power of the concerns to be combined in the trust. The controlled companies maintained their separate existence, and were nominally independent; yet, inasmuch as the holding company elected their directors, it effectively controlled their management, and was able to operate the several businesses in accordance with a unified plan. Other trusts took the form of a corporation owning outright the plants and other property of the companies that were united in the trust. In some cases the businesses taken over completely lost their identity.

Motives for the Movement. The primary explanation of the trust movement was the desire of the manufacturers to restrict or eliminate competition, and thus to establish monopoly prices.

Advantages. At the time when trusts were being created in large numbers, much was said about the economies that would be realized. It was alleged that a trust could conduct the sale of products at a lower cost and to greater advantage. Advertising expenditures could be curtailed, travellers dispensed with, the export trade developed with greater success, and transport costs saved through the filling of orders from the particular section of the trust nearest to the customer. It was maintained, also, that a trust could effect a reduction in the cost of production. Gains were to be realized

through the more continuous operation of plant, the greater utilization of by-products, the specialization of ability, the specialization of plant and machinery, the employment in each plant of the best devices, including patents, and competition between the plants of the trust. It was claimed, too, that the trust could effect certain savings

through its superior bargaining power, notably in its relations with the producers of materials and supplies, the distributors of its products, and its employees.

Disadvantages. The fact that many trusts, notwithstanding the many economies that they were able to realize, have lost their monopolistic position in the industry, justifies the conclusion that there are certain factors that offset the economies. Some of these countervailing factors are: (1) difficulty in securing the high order of administrative ability that is required to manage a business of the dimensions and ramifications of the trust; (2) the tendency of monopoly towards stagnation; (3) the additional financial outlays to which trusts are subjected including an elaborate system of control and supervision, and the purchase of antiquated and inefficient machinery in order to stave off competition; (4) the burden of a highly centralized administrative machinery that deadens the enthusiasm and initiative of subordinate officials.

Trusts in Great Britain. Two outstanding instances of British trusts concern soap and whisky. Lever Bros. started in 1886, and by 1923 the company had an interest, usually a controlling interest, in 150 companies. To-day the company is in the position of a trust so far as relates to the soap trade of Great Britain. It has, also, gone a long way towards becoming a vertical combination controlling everything necessary to the production of soap. The company owns plantations in the tropics and South Seas; it is interested in shipping, whaling, seed-crushing, oil refining, and fisheries, as well as in the production of soap and its by-products. The production of whisky in Great Britain has, since 1925, been almost entirely in the hands of the Distillers' Company, Ltd., which was formed in 1877. Another outstanding trust is Imperial Chemical Industries, a combine formed in 1926 to unite the trusts previously established in the heavy chemical, explosive and dye industries.

International Combines. Many trusts, combines, and industrial organizations of similar character have reached out beyond their country of origin and become international. As examples of these international trusts may be mentioned the Lever group (the Unilever Combine) which, after its British mergers, now controls French, German, Swiss, American, Japanese, Canadian, Australian, and African undertakings; the Ford Motor Company, centred in the United States and with one or more branches in nearly every country in the world; and the Dunlop Rubber Company, Ltd. See also INVESTMENT TRUSTS.

TRUSTEE, PUBLIC. An official established by Act of Parliament for the convenience of testators and other persons who wish to create trusts and cannot find any suitable person to be their trustee. With a few exceptions, the Public Trustee is bound to accept any trust to which he is appointed, but unlike other trustees, he has statutory power to charge for his services. Of late, rival services have been organized by some of the leading Banks. See TRUSTS AND TRUSTEES, below.

TRUSTS AND TRUSTEES. The conception of a trust is one peculiar to English law. Under the feudal system a man who wished to provide for his wife or children was faced with many difficulties. The wife might marry again and then all her property would become the property of her second husband. A youth or a girl would be the wards of their overlord, who would be entitled to take a large share of their estates as the perquisites of his guardianship. The practice thus arose by which a man, instead of giving property direct to his wife or child, would give it to some adult male relative or friend, trusting him to use it for the benefit of the wife or child. Property so given became the absolute property of the donee, who was under no legal obligation to use it for the purpose intended by the donor; the obligation was a moral one only. In time, however, the Court of Chancery (whose function it was to stop up gaps in the law) decided that in future it would enforce this moral obligation. From that time forward, trusts have been an integral part of English law. The person to whom the property is given on trust is called the *trustee*, the person for whose benefit it is to be applied used to be called by the Norman-French expression *cestus que trust* (he who trusts) but is now generally called the *beneficiary*.

Creation of a Trust. The steps ordinarily required for the creation of a trust are (a) the transfer of property to a trustee, (b) a declaration by the donor of the trusts upon which the property is to be held, and (c) an acceptance of the trusts by the trustee.

Powers and Duties of a Trustee. A trustee is strictly obliged to carry out the trusts faithfully and carefully; otherwise he is guilty of a *breach of trust*. If a breach of trust results in a loss to the trust property, the trustee will be compelled to make it good out of his own pocket. If he sells trust property he must invest the proceeds. A certain restricted range of safe investments (generally known as "trustee securities") is specified by law, and trustees must ordinarily invest within this range. See CHANCERY; EQUITY.

TRYON, MAJOR THE RT. HON. GEORGE CLEMENT (born 1871). Conservative politician. He served in the Grenadier Guards from 1890 to 1902. He fought in the South African War and was afterwards Commandant of the London District School of Instruction. He was returned to Parliament as one of the members for Brighton in 1910 and has held his seat since. His first ministerial office was that of Under-Secretary of State for Air (1919), and he afterwards served in two administrations as Minister of Pensions. On the reconstruction of the Government after the election of 1935, he became Postmaster-General, and continued the policy of vigorous expansion in the Post Office and Telephone Service which had been begun by his predecessor, Sir Kingsley Wood.

TRYPANOSOMES, *trip' a nō sōmz*. See TSETSE FLY.

TRYPANOSOMIASIS, *trip a nō sō mī' a sis*. The technical name for African sleeping sickness. See SLEEPING SICKNESS.

TRYPSIN, *trip' sin*. See PEPTONES; PANCREATIN.

TSANA, *tsah' na*. A lake of Ethiopia in the highlands of Amhara at 5760 ft.; area about 1200 sq. miles. From it flows the Abbai or Blue Nile, the smaller of the two main branches of the Upper Nile which unite at Khartoum, Anglo-Egyptian Sudan.

TSANG-PO, *tsahng po'*, RIVER. The name by which the Brahmaputra River is known in Tibet (which see).

TSAR. See CZAR

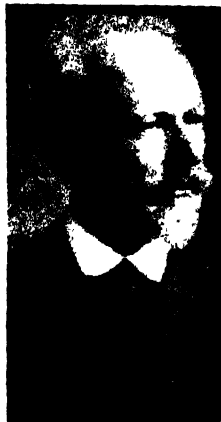
TSCHAIKOVSKY, *chī kof' she*, PETER ILICH (1840-1893). One of the greatest Russian composers, he was born at Votkinsk, in the Urals. In 1862 he entered the Conservatorium of Music at St. Petersburg (now Leningrad). Tschaikovsky was appointed professor of harmony at the Mos-

cow Conservatorium in 1866, and during the next few years he laboured diligently as teacher, composer and musical critic. His first compositions received little favour, and a brief, unhappy marriage, contracted in 1877, further discouraged him.

After a period of relaxation in travel, he had a real success in 1879 with his opera *Eugene Onegin*. About the same time, his *Concerto in B Flat Minor* won high praise. He continued to compose and produce symphonies and operas up to the year of his death, when the famous *Pathetic Symphony*, his sixth, was first performed.

The melancholy of Tschaikovsky's nature is reflected in his compositions, which show great originality and are highly emotional. His works include symphonies, concertos, operas, orchestral fantasies, overtures, ballets, pieces for the piano, vocal duets, and songs. His *Fifth*, *Fourth*, and *Sixth* (the *Pathetic*) symphonies are among the greatest examples of that form of music.

TSETSE, *tset' se*, FLY. A two-winged fly that transmits the animal parasites which cause African sleeping sickness (which see). The parasitic organisms, called *trypanosomes*, all belong to the same genus. There are about twenty species of tsetse-fly, some of which do not attack man. They somewhat



TSCHAIKOVSKY
Photo. Brown Bros.



TSETSE FLIES

The bite of this fly is harmless to men but nearly always fatal to horses, oxen and dogs.

Photo U & U.

resemble house flies, but are a little larger. The tsetse fly is equipped with a long proboscis, which it uses to pierce the skin of its victim. The flies suck the blood of mammals, including wild game, cattle, horses, and man; they transmit to cattle and horses a deadly disease called *magana*. The insect bites an infected animal or person, and transmits the germs by biting an uninfected victim. The germs do not become infective until they reach the salivary glands of the flies, but the hosts are capable of transmitting the parasites for at least ninety-six days.

Fortunately, the female insect does not lay eggs, and the flies breed slowly, producing one larva at a time.

Scientific Names. Tsetse flies belong to the fly family, *Musculae*. *Glossina palpalis* is the species chiefly responsible for the spread of sleeping sickness, while *Glossina morsitans* is responsible for the Rhodesian forms of that disease, and is also the principal carrier of the germ that causes the *magana* disease among domestic animals.

TUAMOTU, *tu ah mo' tu*, ISLANDS. See PACIFIC ISLANDS.

TUAREGS, *tuar' egi*. A nomadic people of Berber origin, living in the eastern and central Sahara. They are camel breeders and traders, restless and warlike, and have offered much resistance to French subjugation of the Sahara and Sudan. Formerly Christian, they are now Mohammedans, but less strict than most followers of that faith. See BERBERS.

TUBA. The English term for the bombardon (which see).

TUBE. See UNDERGROUND RAILWAYS.

TUBER. See BULB.

TUBERCULOSIS. An infectious disease of man and animals caused by the *bacillus tuberculosis*, a micro-organism about $\frac{1}{1000}$ of an inch in length. It was first isolated by the German bacteriologist Koch in 1882. It occurs in several varieties, the most important of which are the human, the bovine, and the avian. Most of the organs of the body are subject to tuberculosis; by far the commonest are the lungs, attacked by the human variety. The bovine variety attacks particularly the lymphatic glands, the joints and the bones. But it is tuberculosis of the lungs to which has been given the names of *consumption* and *phthisis* (which mean wasting), and the *white plague*. As a cause of death it is still one of the commonest in this country, but the death-rate from it has been steadily declining for the last century. In 1840 it was 4419 per million persons living, in 1934 it was only 763 per million.

In urban areas almost every person is infected with the tubercle germ, but of these only a small proportion develop the disease tuberculosis. The body's power of resistance to the disease is gradually strengthened by

the absorption of minute quantities of the poison produced by the few germs with which it is infected; in this way the individual certainly, and probably the whole community, steadily becomes immunized.

Symptoms. The commonest form of consumption begins with a dry persistent cough, with a slight rise of temperature in the evenings, loss of appetite, and a feeling of lassitude. If the disease is not checked, the cough becomes worse, a yellow sputum is produced which may be blood-stained, pain is felt in the lung, the temperature becomes higher, and wasting occurs. If a large blood-vessel is invaded in the lung, a haemorrhage occurs, which may, if severe, cause death.

Modern Methods of Prevention and Treatment. Since the disease is transmitted usually by the scattering of the germs in the sputum of actively sick persons, the latter are taught to spit only into specially made cups containing antiseptic liquid. Patients are segregated as for other infectious diseases, and taught to follow appropriate hygienic practices. The milk supply is rigorously controlled, and though we have not yet succeeded in freeing our breeds of cattle entirely from the disease, yet the risk of contracting bovine tuberculosis is now very slight. These measures, together with the education of the public in hygiene, especially in the value of fresh air and sunshine, have achieved an enormous reduction in the incidence of tuberculosis. In order to treat this disease with any prospect of success, it is of vital importance to recognize its presence at an early stage. A large number of sanatoria are maintained for its treatment, where patients are kept in the open air or in well-ventilated wards, their activities controlled and carefully regulated, their diet scientifically supervised; they are also taught how to look after themselves after being discharged.

TUBEROSE, *tü' ber öz*, or *tüb' riz*. A hot-house plant of the amaryllis family. It is not related to the rose, but allied to the Mexican agaves, the name being a corruption of the adjective *tuberous*. It has a heavy, almost sickening fragrance. The slender stem, often three feet in height, springs from a tuberous rootstock, and bears clusters of funnel-shaped, waxy-white blossoms at the top, and, at the base, six or eight sword-shaped leaves. A native of tropical America and Asia, the flower is now cultivated extensively in Europe and America for perfumes and toilet preparations.

Scientific Name. The tuberose belongs to the family *Amaryllidaceae*. Its botanical name is *Polyanthes tuberosa*.

TUDOR. The family name of an English royal house, or dynasty. Sir Owen Tudor,

a descendant of Ednyfed Vychanap Kendrig, commander under Llewellyn ap Iorweth, married Catharine of Valois, widow of Henry V. This unauthorized marriage caused much indignation, but Henry VI later created their sons Edmund and Jasper respectively Earls of Richmond and Pembroke. Sir Owen was beheaded by the Yorkists in 1461, having been taken prisoner at Hexham. The Earl of Richmond married Lady Margaret Beaufort, a descendant of John of Gaunt, and died in 1456. Their son, Henry VII, was the first Tudor sovereign claiming the throne by maternal right; he, his son Henry VIII, and his grand-children, Edward VI, Mary I and Elizabeth, are the subjects of separate articles. Jasper, Earl of Pembroke, was a strong supporter of his half-brother, Henry VI. After the Yorkist triumph at Barnet and Tewkesbury in 1471 he took refuge in Brittany with his nephew Richmond, whom he aided to the throne in 1485, when he was created Duke of Bedford. He shared in the suppression of Simnel's conspiracy. He died in 1495 without heir; his illegitimate daughter is said to have been the mother of Stephen Gardiner, Chancellor to Mary I.

On the death of Elizabeth, the last Tudor,

in 1603, the throne went to James VI of Scotland, whose great-grandfather, James IV, had in 1504 married Margaret, elder daughter of Henry VII.

TUDOR STYLE. The style of English architecture which prevailed during the period of the Tudor sovereigns, between 1485 and 1603. It was a late phase of the Perpendicular style (which see), a form of Gothic which was characterized by vertical lines. During the reign of Henry VIII, the mansions of the nobility were built on a quadrangular plan, with an inner and a base court and a gatehouse between them. Turrets, decorative chimneys, and bay and oriel windows were popular. Late in the period, the Elizabethan phase of the Tudor style developed. Characteristics of the Elizabethan style are square windows, numerous fireplaces and chimneys, carved wooden staircases, gables, eight-sided turrets, projecting bay window, panelled ceilings, and detailed ornamentation. An excellently preserved example of Tudor domestic architecture is Ightham Mote in Kent.

TUESDAY. The name of the third day of the week, derived from *Tiu*, or *Tiw*, Anglo-Saxon form of *Tyr*, name of the Norse god of war. He was the son of Odin, or



MERRYMAKING AT MADDON HALL

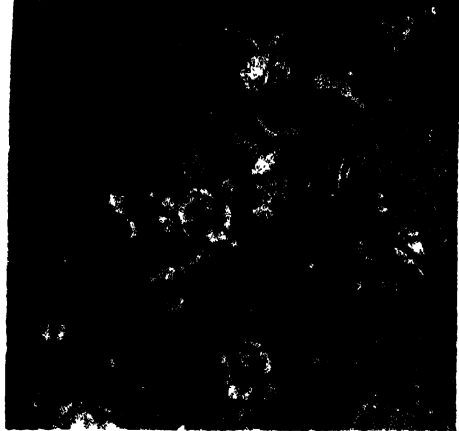
This painting by J. Nash, which visualizes the Hall in Tudor times, shows the Munstrels' Gallery.

Photo. Mansell



TULIP TREE

Photo: Visual Education Service



TULIP TREE, SHOWING BLOSSOMS

Photo: Visual Education Service

Wodin, to whom the day of Wednesday was sacred.

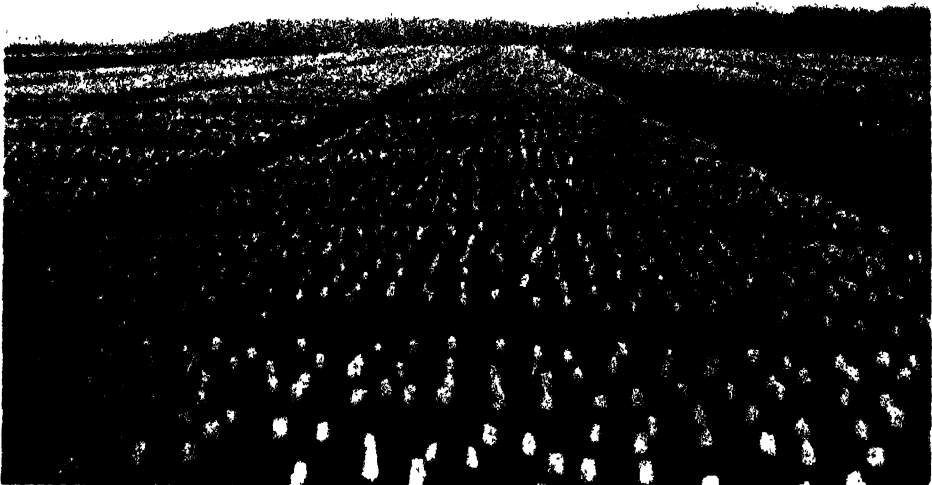
TUPA, *tu'fa*. A porous rock formed by the waters of mineral springs. These waters hold carbonate of lime in solution and deposit these substances on evaporation, forming *calcareous tufa*. Tufa is a coarse rock with a cellular structure, and often contains twigs, leaves, or mosses, around which it has formed. Calcareous tufa is sometimes called travertine (which see).

TULIP. Tulips constitute a genus of the lily family. There are about forty-five species, most of them being native to South-

ern Europe and to the warm regions of Asia. Nearly all cultivated varieties are derived from a species native to Asia Minor, that was brought to Vienna from Constantinople in the sixteenth century. The name itself is of Turkish origin, and means "turban."

The sword-shaped leaves spring directly from the bulb, and the flower stems, which are from 3 in. to over 2 ft. in height, end in a large, graceful, bell-shaped flower. The flowers are single or double, and usually grow erect on the stem. Their coloring is infinitely varied.

* Tulip plants are usually grown from bulbs



TULIP FIELDS IN HOLLAND

Photo: OROC

planted in autumn for spring blooming. They require a well-drained loamy soil of average richness, and full sun.

After the introduction of the tulip into Europe, it became the flower of fashion both in England and in Holland. In the latter country, between 1634 and 1637, interest in the new plant developed into a craze. Individual bulbs sold for fabulous prices. To-day, tulip cultivation in Holland is an important industry, and millions of bulbs are exported annually, nearly 2000 varieties being produced by the Dutch growers. Of

or on the skin. As the term is commonly used, it is applied to harmless or curable growths, called *benign*, and to *malignant* growths, which tend to return after removal. Generally speaking, a malignant tumour is a cancer. Benign tumours range from the harmless "wen" on the body to the fibroid tumour in the uterus. See **CANCER**.

TUMULUS. A term sometimes applied by archaeologists to a barrow. See **BARROWS**.

TUNA. A variant of *tunny* (which see).

TUNBRIDGE WELLS. A Municipal Borough and inland watering-place of Kent,



TULIPS
Photo: Carters

recent years tulip growing has also become important in Devonshire, Lincolnshire and other parts of England.

Scientific Name. Tulips belong to the family *Liliaceae*. The species introduced into Europe from Turkey is *Tulipa gesneriana*.

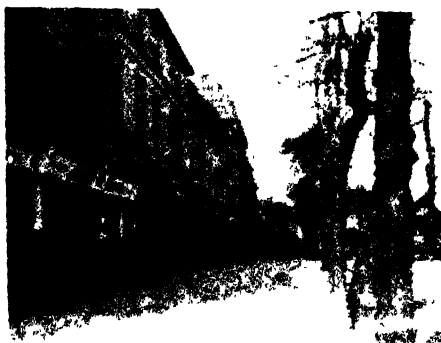
TULIP TREE. A forest tree, native to North America where it attains a height of 190 ft. It takes its name from the close resemblance of its flowers to tulips. It is allied to the magnolia. The fine grained timber is known as whitewood, yellow poplar, or tulipwood. In England it is used for ornament and attains a height of 80 ft.

Scientific Name. *Liriodendron Tulipifera*.

TULLAMORE. See **LEINSTER**.

TULLUS HOSTILIUS. See **ROME**.

TUMOUR, *tū' mur*. An abnormal growth or swelling of an area of tissue in the body



THE PANTILES, TUNBRIDGE WELLS
Photo: Taylor

with an area of 3991 acres and a population of 35,367 in 1931. Its rapid rise to favour and great expansion were originally due to the discovery of chalybeate springs in the early seventeenth century on the estate of the Marquis of Abergavenny. Thereafter the town rapidly increased in size and was frequently patronized by various kings of England, vieing with Bath at the time of its hey-day. The architecture of the present town is largely modern. Attraction is provided by the commons around which the newer residential districts have grown, whilst "The Pantiles"—a paved terrace topped by a piazza—is a relic of the town's most fashionable era, for it was along this promenade that entrance was made to the mineral springs. The denuded sandstone rocks, of which one—the Teal Rock—stands on Rustall Common and of which there is a remarkable display at the Hig^h Rocks, a mile from the station, make a natural phenomenon of scenic and geological interest.

TUNDRA. The name applied to a land of Arctic vegetation which contains no trees, but a few low bushes, some herbaceous plants, and many mosses and lichens. The tundra is bright with flowers for a month or two in summer and frozen for most of the other months. Reindeer and musk-oxen

find a livelihood, and the fox, wolf, lemming and other small animals thrive. Tundra fringes the Arctic coasts of Europe, Asia, and America.

TUNG-OIL. A tree of the spurge family, native to China. The seeds yield tung-oil, used in chemical industries, especially for waterproof varnishes and paints.



STREET IN THE NATIVE QUARTER OF TUNIS
Photo: P. & A.

TUNGSTEN. A hard, brittle, rare metallic element, of great commercial importance. Its chemical symbol is *W*, from *wolfram*, another name for the metal. Among the pure metals, only iridium and molybdenum exceed tungsten in hardness. When added to steel, it gives greater hardness, tenacity, tensile strength, and elasticity; tungsten-steel tools have about five times the efficiency of those made from ordinary steel. Tungsten has the highest melting point of all the metals, 5918° F. (see **MELTING POINT**), a property that makes it invaluable for use in filaments of incandescent lamps. It is used for contact points in spark coils, telegraph keys, and similar devices, and in X-ray and wireless apparatus. See **ELECTRIC LIGHT**.

Tungsten is not found native. Wolframite is an ore of iron, manganese, and tungsten; scheelite, of calcium and tungsten; wolfram ochre is the trioxide. The chief tungsten-producing countries are China, Burma, Japan, Australia, Bolivia, and the U.S.A.

TUNGUSK, *toon goosh'*. A large coal region in central Siberia.

TUNIC, *tū'nik* (from the Latin *tunica*). A word associated with the dress of the ancient Romans. The Latin tunic was an undergarment worn by both men and women, and was fastened about the waist by a belt or girdle. It was covered by the toga when worn by men, and by the stola when worn by women. Roman senators wore a tunic

having two broad stripes of purple down the sides (*latus clavus*), while the tunic of the equites (knights) had two narrow stripes (*angustus clavus*). See **TOGA**.

In the Catholic Church, tunic, or *tunicle*, is also the name applied to a vestment worn by the subdeacon who officiates at Mass. At the present time, any loose, short garment, fastened at the waist by a belt or girdle and reaching from the neck to some distance above the knee, is called a tunic.

TUNING FORK. An instrument of tempered steel in the shape of a narrow "U" with a short projecting stem, used for sounding a note of constant pitch to which other musical instruments may be tuned. It gives a note of almost complete purity, owing to the nearly total absence of upper partials (see **MUSIC**). The device was invented in 1711 by John Shore, sergeant-trumpeter to George I of England.

TUNIS, *tū'nis*. Capital city of Tunisia (which see).

TUNISIA. A French protectorate in Northern Africa. It has an area of about 48,300 sq. miles, and a total population of 2,410,602 (1931) of whom 2,159,000 are Arabs and



IN MODERN TUNIS
Photo: Fax

Herdouins, 56,242 Jews, 91,427 French, 91,178 Italians, and 8643 Maltese. The native population is almost wholly Mohammedan.

The irregular coast-line extends northward from the Gulf of Gabes, or Qabes, and then west to Tabarca, a distance of about 550 miles. The north of Tunisia is mountainous, with fertile valleys descending to the Mediterranean; the centre is a high and somewhat arid tableland; and the south is Sahara desert, with some fertile oases. There is much pasture and arable land, though half the total area is uncultivated. The chief crops are wheat, barley, oats, grapes, olives and dates. Sheep, goats, cattle and horses are reared. There is also some production of citrus fruits, almonds and esparto grass.



RUINS IN OLD TUNIS
Photo. Fox

Mining includes important deposits of phosphates, iron ore, and some lead ore. Industries, mainly domestic, are leather and wool work. There are 1290 miles of railways, chiefly state-owned. TUNIS, with a population of 202,400, is the capital, and is accessible to large vessels. Within a few miles lay ancient Carthage. Other towns are Bizerta, a French naval base; Sfax, the chief mineral port, and Kairwan, the old Mohammedan capital. Tunisia is still nominally under a Bey whose rule dates from the days of Turkish control. France invaded the country in 1881, and proclaimed a protectorate in 1883. Government is now by the French Foreign Office through a Resident-General.

TUNNEL. An artificial subterranean passage, piercing hills or passing under the beds of rivers, and usually made without removing the overlying material. Tunnels are either through rock or earth. Rock offers great resistance to tunnelling, but it has the advantage of requiring usually no support to the top and sides of the bore. The rock is drilled to form pockets, in which are placed charges of high explosive which is then discharged by means of an electric

spark. The shattered fragments of stone are removed as the work progresses. When a tunnel is driven through soft earth or under the mud of a river bed, it is necessary to support the soil above to prevent caving. This is accomplished by supporting the roof of earth with a sheath of timbers or steel, about which cement is poured and allowed to harden. Most tunnels of this kind have a permanent lining.

In the construction of underwater tunnels the most serious difficulty to be overcome is the inflow of water. The situation is met by the use of the compressed-air or the shield system; sometimes the two are used in combination. By the compressed-air method the pressure of the inflowing water is checked by compressing the air in the end of the tunnel where the work is proceeding. The tunnel shield is a cylinder of steel plate, with the front fashioned to form a sharp edge. Hydraulic jacks are attached to the inside surface of the cylinder. Then piston rods, as power is applied, press against the lining of the tunnel already completed, and push the cutting edge of the cylinder into the earth yet to be excavated. Near the front of the cylinder is a partition with openings, which the operators may close at will. As the cylinder is forced ahead, the earth is withdrawn in small amounts through the openings. At the rear end, new lining for the tunnel is constructed with each forward movement of the front edge.

Tunnels have been proposed for undersea connection between England and France, beneath the Straits of Dover; between the Spanish coast and Northern Africa; and beneath the entrance of the Mediterranean at Gibraltar. Considerations of national defence have always blocked such projects.

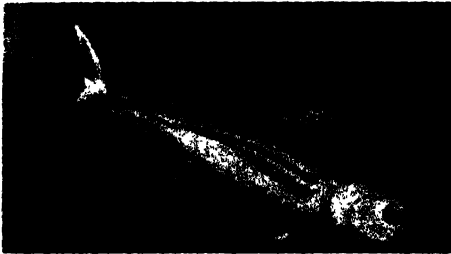
Brunel, the father of the great engineer of the G.W.R., was the inventor of the shield method, and he built the Rotherhithe-Wapping tunnel under the Thames in 1843. Other notable British tunnels are the Blackwall, over 3000 ft. long and completed in 1897; the Severn, over 4½ miles long; and the vehicular tunnel under the River Mersey, completed in 1935. Perhaps the greatest engineering skill has been shown in the construction of the London system of underground railways, in which there are over 90 miles of tunnel, the longest single one being that on the Edgware-Morden Line between Golders Green and South Wimbledon. This is between 16 and 17 miles long and is the longest railway tunnel in the world. On the Piccadilly Line the tunnel

between Baron's Court and Bounds Green is over 12 miles long.

Others of the world's longest tunnels are—

NAME	MILES
Simplon, between Italy and Switzerland	12.45
Pennsylvania R.R. Tunnel, New York	11.7
Apennine, between Florence and Bologna	11.3
St. Gotthard, between Switzerland and Italy	9.25
Loetschberg, in the Swiss Alps	9.04
Hudson and Manhattan, New York	8.5
Mont Cenis, between France and Italy	7.97
Cascade, between Berne and Scenic, Washington	7.79
Arlberg, between Innsbruck and Bludenz	6.36

TUNNY, OR TUNA. The largest fish of the mackerel family, found in all warm ocean waters. Because of the large size and the fighting spirit of these fish, tunny fishing is



TUNNY
Photo: Weller

excellent sport. The fish sometimes reach a length of over ten feet and a weight of 1500 pounds.

Tunny feed largely on squid and smaller fish. The body is shaped much like that of the ordinary mackerel, but is thicker. In Europe the most important fisheries are in the Mediterranean Sea. The flesh is sold fresh and tinned. Many fine specimens are captured in the North Sea off the Yorkshire coast.

Scientific Name. The tunny is *Thunnus thynnus*.

TURBAN. The name of a head-dress, with special reference to that worn by men in Mohammedan countries. In general the turban is a scarf of silk, linen, cotton, or other cloth, folded around the head, or about some sort of a cap. Turbans in Oriental countries show distinctions of rank, profession, and social position. In India, the priests usually wear white head-dresses; the native princes wear ornamental ones, often profusely decorated with jewels. In the days before Turkey became a republic and adopted modern dress, its sultan wore a turban containing three heron's feathers, and further adorned with precious stones. Two heron's feathers appeared in the turban of the grand vizier, and one in those of other officers.

TURBINE, tur' bin, OR TURBINE WHEEL.

A simple type of turbine wheel, commonly known as a *water motor*, consists of a small wheel with cups on the outer ends of its spokes, and enclosed in an iron case. A jet of water under high pressure strikes against the cups and causes the wheel to rotate. A more efficient turbine has an iron wheel with curved blades, or flanges, on its surface, enclosed in an iron case to whose inner surface blades similar to those on the wheel, but curving in the opposite direction, are attached. The wheel is placed several feet lower than the surface of the water to be used as a source of power, and is connected with the water supply by an iron pipe



IMPULSE TURBINE.
A 25-ton bucket wheel for a 30,000 h p. unit.
Photo: 1215 Chalmers Manufacturing Co.



TURBAN

(a) Style worn by Christian priests in North-western Asia; (b) Morocco turban; (c) Syrian; (d) turban of citizen of Damascus. In the National State of Turkey the turban is disappearing, the European hat having taken its place (among officials by government decree).

When the water enters it flows through openings in the case against the blades on the wheel, which is made to revolve by the pressure of the water.



TURBOT
Photo: Waller

Since the pressure of water is increased by its depth, a wheel fifty feet below its source of water supply will have twice the power of a similar wheel twenty-five feet below the water. Turbines of this type are known as *pressure turbines*, and they may be used to operate large dynamos which develop electric power.

Steam Turbine. The steam turbine is a prime mover which generates motive power in the same manner as the old windmill; but, instead of a current of air being used to rotate the shaft by means of *sails*, as in a windmill, a current or blast of steam, issuing from a number of fixed nozzles, is employed. It operates on the same principle as the water turbine, except that it makes use of both the direct pressure and the expansive power of steam. The most satisfactory type consists of a series of turbines, each succeeding one being a little larger than the one before it, to adapt the motor to the expansion of the steam. The blades on the wheel and those on the enclosing case curve in opposite directions, as in the water turbine. Steam turbines are used for propelling steamships and for operating large electrical generators.

In powerful steam turbines on shipboard the drive is not direct, but is transmitted to the propeller shaft by reducing gear, which prevents loss of power due to "cavitation" (or too rapid turning in the water) and allows of a suitably large propeller.

For turbine developments in warships, see *NAVY (History of Warships)*.

In recent years the turbine principle has been applied with success to steam locomotives, in which it produces rapid acceleration and silent running and eliminates the vibration that has been reduced, but not removed, with reciprocating traction. The

turbine locomotive also burns 15 per cent less fuel.

TURBOT. One of the largest of the flat-fishes. It has a very flat, wide body, with long fins on the top and bottom ridges. Its upper surface is brown and covered with hard, round knobs. The turbot is a sea fish, and its eggs—five or ten million to a fish—float on the ocean surface. The full-grown turbot prefers a sea bank, where it lies on its lighter side. Both the eyes are on the left side of the body. The turbot abounds off the western coast of Europe and in the Mediterranean, where it is caught for export.

Scientific Name. The European turbot is *Rhombus maximus*.

TURGENIEFF, turgen'yef (also spelt TURGENEV), IVAN SERGEYEVICH (1818-1883). A Russian novelist, born at Orel. He was educated at the universities of Moscow and St. Petersburg (now Leningrad), and under private instructors at Berlin.

In 1852 Turgeneff won praise for *A Sportsman's Sketches*, describing the sufferings of Russian peasants. *A Nest of Nobles* once more drew a vivid contrast between the aristocracy and the working classes of Russia. This was soon followed by *Fathers and Sons*, *Smoke*, and also *Virgin Soil*.

It was Turgeneff who coined, in his *Fathers and Sons*, the word *nihilist*, meaning a man "who bows before no authority, and accepts no principle unproved." Accuracy of observation, deep sympathy and understanding, and good characterization are the main features of his writings.

TURIN, tū'rin. In Italian TORINO (tō're'no). A city of Piedmont surrounded by mountains, on the River Po. It is eighty miles north-west of Genoa and seventy-six miles south-west of Milan.

The city dates from Roman times. Hannibal captured it after crossing the Alps in 218 B.C. It was partly burned down in A.D. 69. From 1861 to 1865, it was the capital of the kingdom of Italy.

Turin is a flourishing and important industrial centre, particularly for the motor-car and silk industries. It has developed as an important military station, because of the proximity of the French boundary and the Alpine passes. The present population (of city and suburbs) is 635,460.

TURKEY. In an earlier day one of the most powerful countries of the world, whose domain spread into three continents, Turkey is no longer a great power; but it is important politically in that by reason of its geographical position, it holds a threat to other nations whose interests clash with it. Turkey controls the Bosphorus, the Sea of Marmora and the Dardanelles—which together form the only outlet to the Black

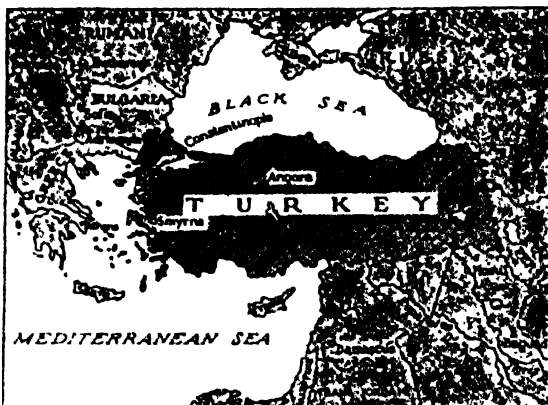
Sea—and is now permitted to fortify and garrison strategic points along the straits.

To the Sultans once belonged the European regions of Greece, Macedonia, and the Balkans; in Asia they ruled Asia Minor, Armenia and Kurdistan, Mesopotamia (Iraq), Syria, and part of Arabia; and in Africa, Tripoli and Egypt. Vast and unwieldy, the empire was called Turkey-in-Asia and Turkey-in-Europe, to distinguish its regions so widely separated in nationality and situation.

This empire has shrunk until the present Turkey-in-Europe consists of only the cities of Istanbul (Constantinople) and Adrianople and the eastern part of Thrace around Adrianople, with its extension, the Gallipoli peninsula; while all that is left of Asiatic Turkey is the province of Anatolia, or Asia Minor, and Imbros, Tenedos, and other islands in the Mediterranean. The African possessions were lost in 1912 and 1915. The total area is estimated at 294,416 square miles, of which 9257 square miles are in Europe. The population is 16,200,000 (1935).

The People. In the years following the overthrow of the Ottoman Empire, a marked unification took place in the people of Turkey. The fortunes of war, and the wholesale exchanges of Greeks and Armenians within the republic for Turks living outside the new limits of Turkey, reduced the number of nationalities once so characteristic of the empire. In Turkey of to-day a steady policy of Westernization is being carried out. Turks have laid aside the fez, the red cap so long symbolic of their race. Upon the streets and in the theatres, men and women are seen together. The new status of women is perhaps the most obvious social change: with the coming of the republic, a new freedom for women has been achieved in social and in public life. The veil is now optional, and about ninety per cent of the women wear European head-gear. In the universities, in the courts, in offices, even upon the stage, the Turkish women are seen.

Religion. Under the republic, religion has been strictly separated from the government. The state-supported schools are not permitted to teach any religion whatsoever.

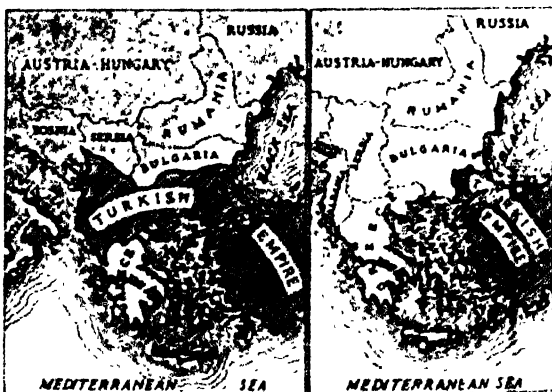


THE NATIONAL STATE OF TURKEY



BOUNDARIES OF TURKEY IN 1683

The dates on the map are those at which the various provinces were lost.



TURKEY IN 1878 AND IN 1913

Left: Turkey's boundaries as fixed by the Congress of Berlin. Right: The Balkan states, showing the limits of European Turkey and the national boundaries after the Balkan Wars.



IN PRESENT DAY TURKEY

Top: Transporting Smyrna rugs to market.
Bottom: Street merchants in Constantinople.

Photos: Kevitone

In 1924, Turkey abolished the caliphate, thus relinquishing the spiritual rule of the Islamic world. In 1926 legislation suppressed the *Ulema*, persons formerly connected with the official duties of Islam, and considered a separate class. Only an Imam, to conduct religious services, remains. The Moslem Friday has been abolished in favour of the Sunday as a day of rest.

Education. Large sums of money are being expended on education, and school attendance has more than doubled since 1914. Education is compulsory in the elementary grades for pupils between the ages of seven and sixteen. Lack of teachers and equipment has been a handicap in some of the more remote regions, and it has not always been possible to enforce the compulsory-attendance law. Moslem schools, closed in 1924, have been replaced by government schools. The University of Constantinople was founded in 1900 and reorganized in 1918, when faculties of arts and science were added.

There are many foreign schools conducted more or less on missionary lines. One of the most far-reaching changes made by the new

government was the adoption of the Latin alphabet to replace the Arabic symbols.

The Cities. Foremost among the Turkish cities is Constantinople (since 1929, Istanbul), the meeting-place of the East and the West. On the Aegean coast is Smyrna (now Izmir); it is 2500 years old. These are described in separate articles. Others of the more important cities are the following—

Adana (now *Seyhan*), thirty miles from the Mediterranean, lies in the cotton area, and has prospects of becoming an important industrial city. A railway connects it with Tarsus. Population, 76,306 (1935).

Adrianople (since 1929, Edirne) is in the small strip of Turkish territory which, with Istanbul, remains in Europe. It is only a few miles from the boundary of Bulgaria.

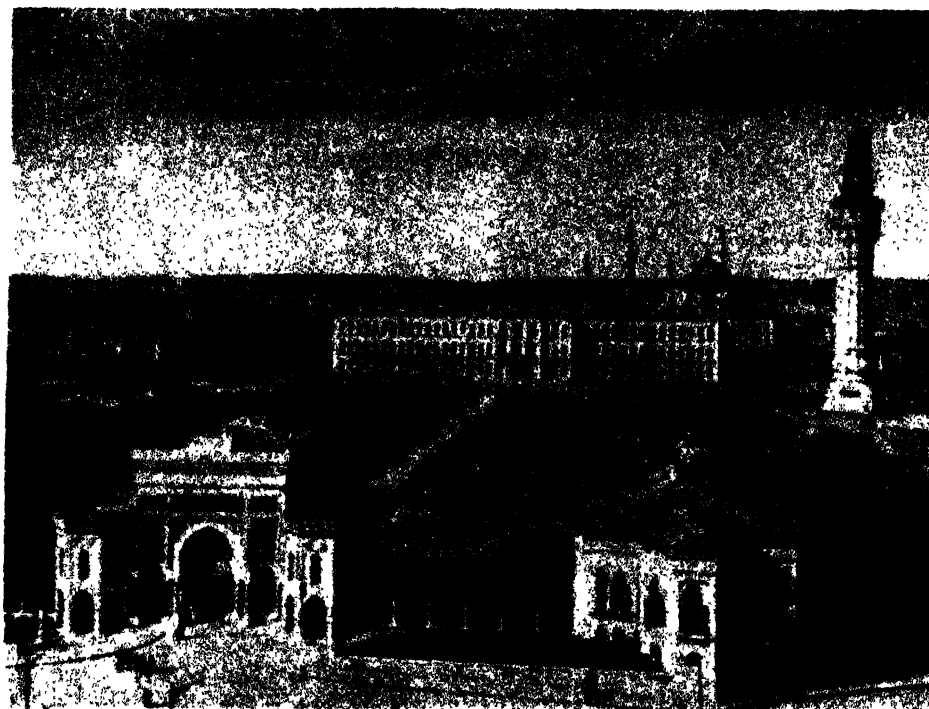
According to historical records, Adrianople was founded by the Emperor Hadrian (A.D. 76-138), on the ruins of an ancient Thracian city. During the Balkan Wars, it was besieged by the Bulgarians and Serbians for six months, and surrendered on 27th March, 1913, only to be recaptured four months later. The surrounding country is rich in agricultural products, and fruits are grown from which some of the finest Turkish wines are made. The principal exports are raw silk, cotton, opium, rosewood, wax, and turkey-red dye. The manufactures are silk, woollen, and cotton stuffs, attar of roses, and leathers. The population is 36,000 (1935).

ANKARA, *an kah' ra*, formerly known as **ANGORA**, in the interior of Anatolia, is the present Turkish capital. It lies on a rocky hillside, almost unassailable from the



PUBLIC LETTER-WRITER AT WORK

Photo: Kevitone



UNIVERSITY OF LAWS AND LETTERS, CONSTANTINOPLE
One of the most modern buildings in the city.

Photo: Keystone

north, and commanding, on the south, a vast open plain. There is good rail and telegraph connection with Istanbul. It was long the seat of the Council of the Nationalist party, and here the National Pact, the Turkish Declaration of Independence, was drawn up.

Once a flourishing city dating from the third century B.C., Ankara later became an unimportant inland town.

A large portion of the old city has now been torn down, and more than 3000 new buildings in approved Western style have been erected; the city has also been modernized with regard to lighting, sanitation, etc. Many factories with modern equipment have been constructed. The chief manufacture is mohair cloth, and wool, mohair, and grain are exported. Population, 123,699 (1935).

Bursa is an ancient and beautiful city situated near the Sea of Marmora. It is said to have been built by order of Hannibal. It is a centre for the silk-spinning industry. Population, 72,276 (1935).

Konia or Konya. An inland town, the ancient Iconium, situated on the main line of railway from Smyrna to the south-east, 140 miles south of Ankara, in a country suited to stock-raising and forestry. It has

woollen, carpet and leather industries, some mercury and other ores are mined. Population, 47,286 (1935).

Samsun, a port on the Black Sea coast, is an important shipping point for the well-known Turkish tobacco, the finest variety being raised in this region. Population, 13,839 (1935).

Trebizond (since 1929, *Trabzon*), on the Black Sea, is an ancient town, commercially important since early Greek times, because the chief trade route from Persia to Europe descends to the sea at this point. Population, 28,713 (1935).

The Land and Rivers. Anatolia is in the main a tableland of 3000 ft. flanked by ranges on north and south and opening to the Aegean Sea. The fertile lowland in the west is the Levant.

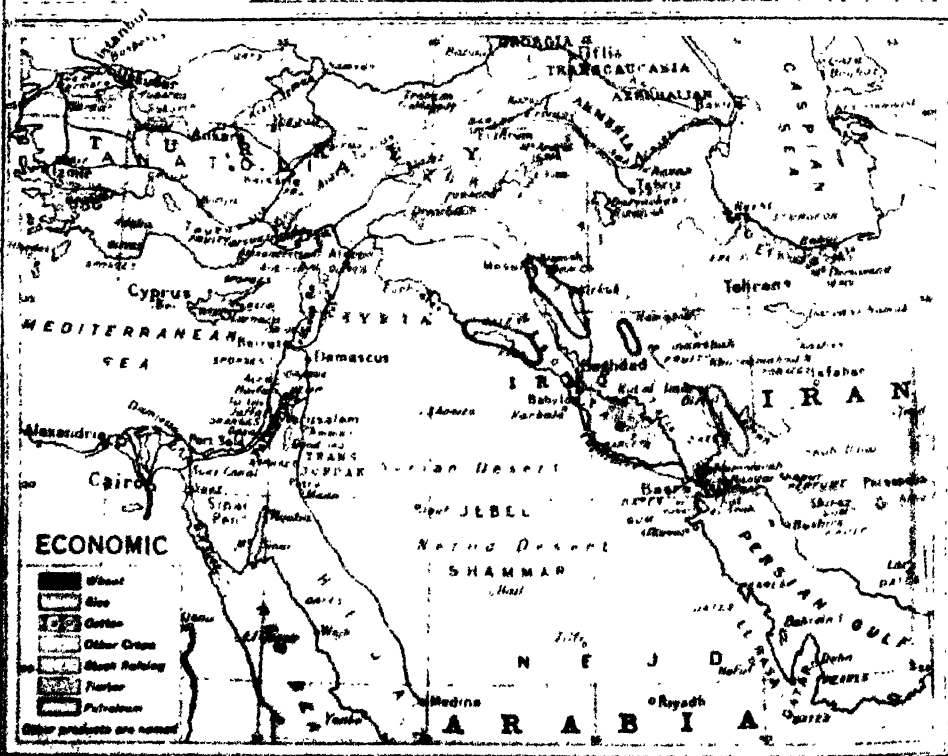
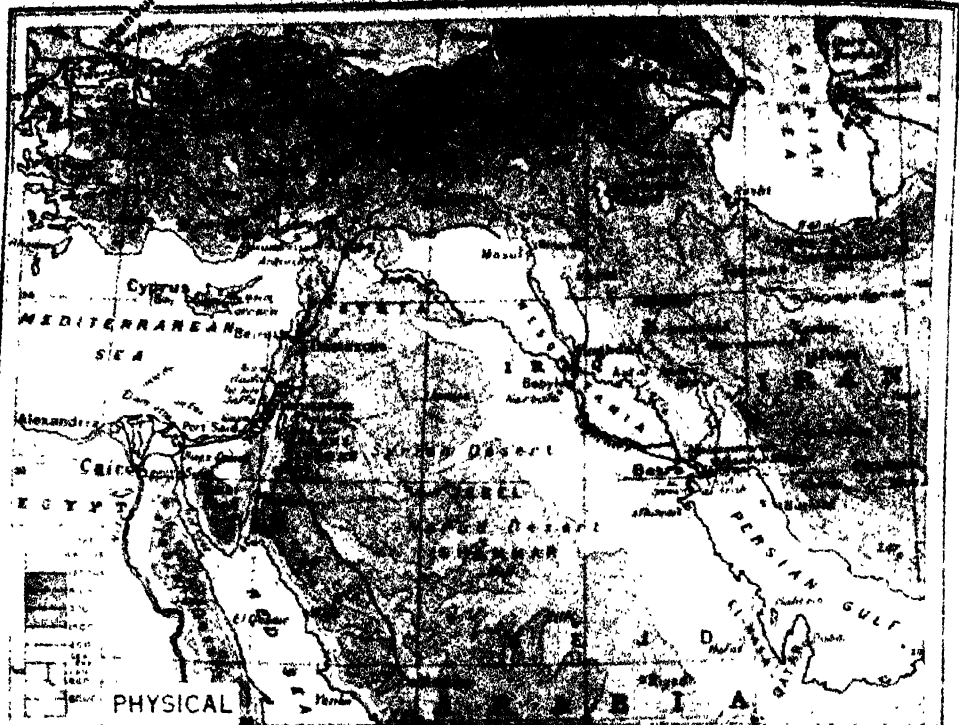
The tableland is not well adapted to agriculture, but irrigation has been of great benefit in the few districts where it is practised. The surface of the plateau is largely treeless, with numerous salty lakes and marshes; it is essentially a grazing country. In the east there are mountain peaks 12,000 ft. high, while on the south the Taurus Mountains rise to about 7000 ft., with several



**TURKEY, IRAQ, IRAN,
AND ARABIA
POLITICAL**

Scale
0 100 200 300 400 500 Miles
0 100 200 300 400 500 Kilometers

U.S. GOVERNMENT PRINTING OFFICE: 1934



peaks reaching altitudes of over 10,000 ft. Valuable forests clothe the mountains which border this tableland. It is estimated that, of the 20,765,000 acres under forests, the state owns about eighty-eight per cent.

Several rivers cut across the plateau and empty into the Black Sea or the Aegean Sea. The longest entirely in Turkey is the Kizil Irmak.

Climate. Along the coast the climate is that of the Mediterranean countries, with

among the leading exports, while silk, cereals, wool, and timber products are other important items. Sugar-beet has been introduced, and has proved successful. Stock-raising is highly important, and Angora goats and sheep are a source of wealth to both agriculture and industry.

Fisheries. Turkey has a valuable source of profit in the waters of the Black Sea and the Bosphorus, for anchovies, mullet, sturgeon, and tunny abound. Lobsters, mussels, and oysters are found in the Sea of Marmora.

Mining. Mining has received little attention, but Anatolia holds riches for the future. Gold, coal, lead, copper, salt, and petroleum are found. The mines near Eski-Shehr are the chief source of meerschaum, valued in the manufacture of pipes. Oil in the Mosul area added to the difficulty of assigning that region, but a satisfactory arrangement was finally reached, whereby Turkey receives a revenue from oil obtained there, although it was obliged to relinquish the land to Iraq. A rich vein of coal has been discovered on the Black Sea coast near Eregh.

Industries. The deportation of the Greeks and Armenians after the World War was a serious blow to Turkish industry, as these races had furnished the merchants and business men of the old empire. Vigorous measures were taken; several industries, such as the exploitation of salt and the manufacture of tobacco products, matches, and cigarette paper, were nationalized, and the government supervised the manufacture and sale of alcohol and alcoholic beverages. Factories were given government assistance and relief from certain taxes. Carpet-weaving is still one of the chief industries, the manufacture of rugs, cotton, and mohair goods and the curing and exporting of tobacco, or its manufacture into cigarettes, furnish employment for many.

The total length of railway in 1935 was about 3850 miles, and there is nearly as great a mileage under construction. The Anatolian Railway, running from Istanbul to Ankara and Konia, is one of the main lines. Among the newer railways are the Ankara-Sivas, Samsun-Sivas, and Ankara-Eregli lines.

Government. Since the Constitution of 1924, Turkey has been officially the National State of Turkey, ruled by a National Assembly and with a President instead of a sultan. The Assembly exercises the legislative power directly; the executive power is entrusted to the President—who is elected by the Assembly to serve a term corresponding to the term of the body which elects him—and to a Cabinet, chosen by the President. The Assembly enacts the laws, makes war, treaties, and concessions, and it



CHANGING THE ALPHABET IN TURKEY

Kemal Atatürk, organizer of the new Turkey, is attempting to raise the people from their unlettered condition to one of comparative enlightenment. The old Turkish letters have been discarded, and the English alphabet has been adopted. Above is a lesson in the new form of letters which appeared in a Constantinople paper.

Photo OROK

hot summers, cool nights, and winters tempered by the sea; in the interior, the summers are hot and dry and the winters both long and cold.

Agriculture. Although Turkey is chiefly an agricultural country, the methods in use are still largely primitive.

The principal agricultural products of Turkey are tobacco, cotton, figs, olives, fruits, and nuts. Tobacco and raisins are

also controls financial affairs. Since 1934 it has been enacted that the president shall be chosen from the deputies who form the National Assembly.

The foreign "capitulations" have been abolished.

HISTORY

The Ottoman Turks were originally an Asiatic people, and their movement westward from their home in Persia (Iran) began in the early thirteenth century, when they made their way to Asia Minor. Here Osman, or Othman, from whom their name was taken, built up an independent empire on the ruins of that of the Seljuk Turks. The sultans who followed Osman not only spread their rule over all of Asia Minor, but extended it into Europe as well, gaining possession of Serbia, Bulgaria, Greece, and Macedonia.

More than once the Turkish armies were led against the great stronghold of Constantinople in vain, but in 1453 Mohammed II, "the Conqueror," captured the city, and the Byzantine Empire was at an end. Constantinople was made the centre of Turkish rule.

Wars and Conquests. Mohammed II attempted wider conquests in Europe, aiming especially at Hungary. The empire continued to prosper for about a century, and under Solyman the Magnificent (reigned 1520 to 1566), it reached the height of its power and splendour.

Then, under weak sultans, the glory of the Ottoman state declined. In 1571 the fleets of Venice and Spain inflicted a severe defeat upon the Turkish fleet in the memorable Battle of Lepanto, and in the years that followed, Persia recaptured considerable territory in Asia. At St. Gotthard the Turkish armies were defeated by the Austrians in 1664. Nineteen years later, Vienna was again besieged by the Turkish forces, but Poland's king relieved the city and saved Central Europe from the rule of Mohammedanism.

Early in the eighteenth century, the Turks came into conflict with Russia, which, during the reign of Peter the Great, had become a strong power. By 1774 Turkey was forced to give up the Crimea and other territory in the region of the Black Sea, open its waters



PORT RUMELI HISAR

It was built on the European side of the Bosphorus by Mohammed II of Turkey in his campaign against Constantinople in 1453. It is said to have been completed in forty days, and Constantinople fell after a siege of 53 days.

Photo: Keystone



OLDER PART OF AYKARA, THE MODERN CAPITAL OF TURKEY

Photo U. & U

to Russian vessels, and allow Russia a partial protectorate over Walachia and Moldavia. Another war, which lasted from 1787 to 1791, ended in further territorial loss to the Turks.

The Nineteenth Century. Egypt was conquered by Napoleon in one of his early campaigns, and was later restored by England. From 1806 to 1812, Turkey was at war with Russia, and at the close was obliged to give up all claim to the territory between the Dniester and the Pruth. In 1821 Greece declared itself independent, and after an heroic struggle, made good its claim.

Between 1831 and 1839 there was intermittent warfare between Mehemet Ali, viceroy of Egypt, and the sultan, and only the intervention of other European powers prevented the complete overthrow of Turkey. As it was, Mehemet Ali was recognized as hereditary viceroy of Egypt, owning allegiance, however, to Turkey.

Russia was determined to take advantage of Turkey's gradual weakening to aggrandize itself, while the other great powers desired the preservation of Turkey, that Russia might not profit too much. Thus, in the Crimean War, Turkey had England and France as allies against Russia (see CRIMEAN WAR). The problem was by no means settled,

and when, in the years following 1875, the Montenegrins, Serbians, and Bulgarians rose in revolt against Turkey, Russia announced herself as their champion.

The Russo-Turkish War of 1877-1878 followed, in which the Turks were defeated and compelled to agree to terms which meant the practical disruption of the empire. Again the powers intervened, however, and in the Congress of Berlin forced Russia to surrender a large part of the advantage gained. In 1881 Thessaly and a part of Epirus were ceded to Greece; and in 1885 the revolution at Philippopolis compelled Turkey to consent to the annexation of Eastern Rumelia to Bulgaria.

The Period of "Reforms." Meanwhile, within the empire revolts were almost constant. An especially serious one in Macedonia in 1903, which the Turks attempted to put down by brutal massacres, led to the intervention of the Western nations, whose governments demanded reforms. In 1908 a reform party, the Young Turks, made a demand for constitutional government, and forced the sultan to accede to their demands. These disturbances gave the neighbouring states the opportunity for which they had been waiting, and in 1908 Austria-Hungary announced the annexation of Bosnia and

Herzegovina, while Bulgaria, the same year, proclaimed its complete independence.

The Young Turks found difficulty in establishing their reform principles in Constantinople, and in 1909 they were forced to put down a serious revolt. Since this revolt had had the support of the sultan, Abdul-Hamid, they deposed him and made his brother, Mohammed V, sultan in his stead.

Disastrous Wars. In 1911 war broke out with Italy, and in October, 1912, when the struggle closed, Turkey gave up its hold on Tripoli and Cyrenaica (now Italian Libya). Then, before the exhausted country had recovered from this brief but sharp conflict, the allied Balkan states declared war on Turkey. At the end of this war, Turkey was compelled to give up all its European territory but Constantinople, Adrianople, and a little of the surrounding region.

The World War and its Results. Turkey joined the Central Powers in November, 1914. Though the Turks successfully resisted an allied attempt to force the passage of the Dardanelles and capture Constantinople (February-December, 1915), they saw the gradual disintegration of the empire as the war progressed. In January, 1915, Egypt passed under British control. In 1916 the Arabian province of Hejaz, having an area of about 96,500 square miles, revolted, and an independent kingdom was proclaimed. Jerusalem and the rest of Palestine, Syria, and Mesopotamia were conquered by the British before the Turkish government asked for an armistice in October, 1918. The

Straits and Constantinople were in the hands of the Allies, and the Greeks occupied Smyrna in order to block Italy's designs upon Anatolia.

Kemal's Leadership. Kemal first summoned a National Congress at Erzerum in 1919. In 1920 the Parliament at Constantinople signed the *National Pact* in which Turkey first declared its rights to Anatolia, Eastern Thrace, and Mosul; asked that the foreign privileges be abolished; and agreed to the internationalization of the Straits. In 1920 the Allies forcibly occupied Constantinople, and although they had agreed to recognize the Nationalist Parliament if it met in Constantinople, the British forces arrested its representatives. Those who escaped fled to Ankara, where the Parliament was re-convened and Mustapha Kemal was elected President. From 1920 to 1922, Asia Minor was under the government of the Assembly, while the Sultan's government was effective only in Constantinople and district.

The *Treaty of Sèvres*, which was signed by the Sultan's emissaries in 1920, gave most of Eastern Thrace and Smyrna and the surrounding area provisionally to Greece, and mapped out spheres of French and Italian influence in Anatolia. All Turkey raged when this treaty was signed. In Anatolia the Nationalists took on new courage. Early in 1921, Turkey and Russia signed a treaty of friendship, and Russia was the first to recognize the Nationalist government in Ankara. A change of government in Greece, by which King Constantine was returned to

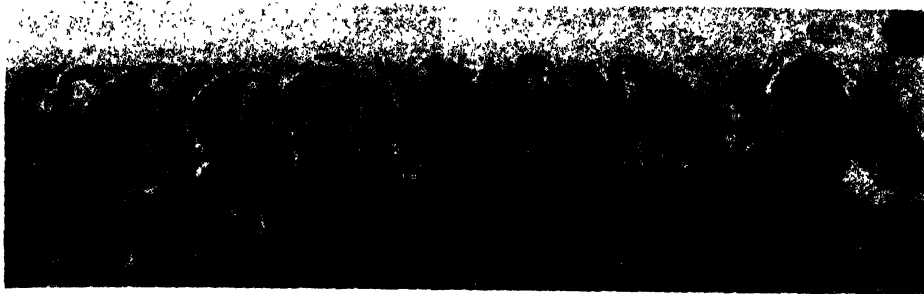


SULTAN AHMED MOSQUE THE LARGEST PLACE OF WORSHIP IN CONSTANTINOPLE

Photo: Keystone



BYZANTINE TOWERS OF A TURKISH CASTLE OVERLOOKING THE BOSPHORUS AT CONSTANTINOPLE (ISTANBUL)



TURKEY COCKS

power, and the continued defeats of the Greek troops, caused the sympathies of the Allies with Greece to wane. It became quite evident that the Treaty of Sèvres would have to be recast. New Greek offensives, begun in July, 1921, were defeated. In October, 1921, France made a separate treaty with the Nationalists, withdrew from Cilicia, and retroceded to Turkey a strip of territory along the Syrian border. The Greek forces were defeated in 1922 in a Turkish offensive (see SMYRNA), an armistice with the Allies was signed, and the peace conference at Lausanne was opened. See LAUSANNE, TREATY OF.

Formation of the Republic. In November, 1922, the National Assembly abolished the sultanate, and the caliphate, or spiritual authority, was offered to Abdul Mejid Effendi, cousin of the deposed sultan. A year later, the caliphate, so long the symbol of Turkey's spiritual leadership of the Moslem world, was cast aside, and Turkey began a thorough course of secularization of schools, courts, laws, and customs. Turkey was declared a republic, Mustapha Kemal was elected President by the Assembly, and Ankara took the place of Constantinople as the official capital.

Turkey's relations with the European powers were settled at Lausanne, Turkey winning its demands on all points save the Mosul question. That was not settled until December, 1925, when the Council of the League of Nations decided that the Mosul area should remain a part of Iraq and under British Mandate; Turkey, however, was to derive a ten per cent profit from the oil wells of Iraq during the twenty-five years of the British Mandate. To achieve the nearest approach to national unity, the Orthodox Greeks in the new Turkey were exchanged for Moslem Turks in Greece.

In 1932, Persia ceded to Turkey the eastern or Iranian side of Mount Ararat, in return for two tracts of land along the southern frontier of Turkey, and assistance in the rebuilding of a highway between

Tabriz and Trebizond. The Mount Ararat territory was necessary to Turkey if she was to control the troublesome Kurdish tribesmen who made raids across the Turkish frontiers. Turkey became a member of the League of Nations in 1932. See KEMAL (MUSTAPHA) ATATURK.

TURKEY. One of a group of game birds related to the pheasants and native to North America. There are but two species—the Yucatan and Central American turkey, a small, brilliantly coloured bird with eyelike spots on the tail coverts; and the wild turkeys of Mexico and the United States, represented by five sub-species. The wild turkey of Southern Mexico is the breed from which the domesticated turkey of the poultry yard is derived.

The common wild turkey is rapidly approaching extinction. The adult male is about 4 ft. overall, clothed in handsome plumage with metallic-green, copper, and bronze reflections. The body feathers are tipped with black, and the tail and upper tail coverts with chestnut. There are fourteen to eighteen feathers in the tail. A long tuft of bristle-like feathers hangs from the centre of the breast, the legs are spurred, and wattles are found on the head and neck, which are bare of feathers. The female is smaller and has duller plumage, and she lacks the tuft of bristles.

In their native haunts in the forests, these turkeys congregate in small flocks, coming into the open only to secure food. They are fond of nuts, seeds, insects, berries, and other small fruits. At night they roost in the trees. The crude nests, lined with dry leaves, are placed on the ground. Turkey eggs are about twice as large as those of the common fowl, and are pale cream-buff, speckled with brown.

The hen usually produces a brood of about twelve and but one brood a year.

Scientific Names. The turkeys are placed in the family *Meleagridae*. The Yucatan turkey is *Meleagris ocellata*; the wild turkey is *M. gallopavo*. The Southern Mexican form is *M. mexicana*.

TURKISH BATH. See BATHS AND BATHING.

TURKISTAN, *toor his tahn'*. A name applied to the region in Central Asia extending eastward from the Caspian Sea to the boundary of China, and from the Kirghiz steppes southward to Persia, Afghanistan, and India.

Russian Turkistan extends from the Caspian Sea east to Mongolia and Sinkiang, north to Siberia, and south to Persia, Afghanistan, and India. It includes two constituent republics of the Soviet Union, Uzbek and the Turkmen, and the autonomous republics of Kazak, Kirghizia and Tajikistan (see separate articles).

Chinese Turkistan, situated in the heart of Asia, extends east from Russian Turkistan to the Gobi Desert and Tibet. It is enclosed between the Tian-shan ranges on the north and the Kuenlun Mountains on the south. It is now a part of the Chinese province of Sinkiang.

History. Through this country passed the caravans of early times, bearing the products of trade from the East to the West and back. Bokhara and Samarkand were rich commercial cities in the sixth century, when they were conquered by the Turks. Following the conquest of Persia by the Saracens, about the seventh century, the country beyond the Oxus River was soon overrun by the Mohammedans. In 1073 Malek Shah, sultan of Turkey, annexed Turkistan, and it was numbered among the conquests of Genghis Khan early in the thirteenth century. Timur, the Tartar, a direct descendant of Genghis Khan, set up a dominion with Samarkand as his capital. He reigned from 1370 until his death in 1405.

The Kirghiz tribes with their two main branches, Kazak, or Cossack, and Kara (Black), represented the most disturbing element in Turkistan. Whether it was the unruliness of the Kirghiz or the ambitions of Peter the Great which caused Russia to adopt a coercive policy toward Turkistan, is questioned. Be that as it may, by 1734 Tsarina Anne (1693-1740) obtained the formal surrender of the Kirghiz, though it was almost the middle of the next century before they were in fact subdued. In 186, Tashkent was stormed and taken; three years later, the same fate befell Samarkand; in 1873 the Lower Oxus, including Khiva, was conquered, and in 1876 Kokand. In 1881 the Tekke Turkmens, one of the most numerous nomad tribes of Turkistan, defended their fortress, Geok Tepe, in one of the fiercest battles of the Russo-Turkish campaigns.

At the beginning of the World War, the people of Turkistan revolted under the lead

of the Kirghiz tribes. Following the Russian revolution, the Soviets extended their power into Western Turkistan.

Afghan Turkistan. A considerable portion of the territory long called Turkistan now forms a northern province of Afghanistan, known since 1927 as the Mazar province. It is bounded on the north by the Oxus River and on the north-west by Russian Turkistan. It was long ruled by Uzbek chiefs, but has formed part of Afghanistan since 1859. The area of the province is about 57,000 square miles, or almost a quarter of the total area of Afghanistan. The population is about 800,000, mostly of Persian and Uzbek stock, with some Mongols, Hindu, and Turkmen tribes. The land is mountainous, and agriculture flourishes only in the river valleys, which are well cultivated. The chief town is Mazar-i-Sharif, which carries on a large trade in astrakhan and furs.

TURKMEN SOVIET SOCIALIST REPUBLIC, also known as **TURKMENISTAN**. One of the constituent republics of Soviet Central Asia, extending from the Caspian Sea to the Oxus River, and bounded on the north by Kara-Kalpak and Kazak. It is made up of the former Trans-Caspian region, part of Bokhara, and part of Khiva. These divisions were united in 1924, when Russian Turkistan was partitioned along ethnic lines, in 1925 Turkmen entered the Union of Soviet Socialist Republics.

The country is peopled by nomadic tribes who are estimated to number 1,268,000. They are principally Turkmens, Uzbeks, Russians, and Persians. The country, 189,603 sq. miles in extent, is mainly desert plains, with a mountainous region to the south. The climate is very dry, and cultivation is practically impossible without irrigation. Despite the nomadic nature of the people, agriculture is their main occupation, and wheat, rice, cotton, and fruit are produced. Water-melons and other fruits are grown, and silkworm raising is important. Sheep and cattle are bred, and the astrakhan fur from the sheep of this region is in great demand. It is also the home of a special breed of horses. The mineral resources include ozocerite, a wax-like mineral used in making candles; oil, sulphates, common salt, and sulphur.

Cotton, and wool-cleaning, silk-weaving, carpet-making, and fruit-drying are the chief industries. The Turkmen carpets, made in the homes of the natives, are famous. There are about 935 miles of railway, and a motor road, recently completed, provides communication across the mountain barrier which separates the republic and Persia (Iran).

Ashkhabad, the capital, is a frontier town on the Akkal oasis. It is attractively laid out, and has wide streets with beautiful trees. The manufacturing plant includes cotton mills, tanneries, and brickworks. The Trans-Caspian Railway provides transport, and a recently constructed electric-power plant offers additional inducements to industries. Population, about 54,000.

TURKS. In a broad sense, the name of the Mohammedan subjects of the former Ottoman Empire, now the National State of Turkey. The name is applied more specifically to the Osmanli, or western Turks, who were conquerors of Constantinople and to the inhabitants of Turkey.

TURKS AND CAICOS ISLANDS. A dependency of Jamaica, although structurally part of the Bahamas group. They are thirty low-lying coral islands with a total land area of 165 sq. miles. Eight are inhabited. The total population is about 5600, chiefly negroes. Salt-collecting and sponge fishing are of importance. Grand Turk is the seat of administration.

TURKU. See FINLAND.

TURMERIC, *tur' mer-ik*. A plant native to southern Asia, the fleshy rhizomes of which are the source of a substance, also called turmeric, which is used mainly for dyeing and in pickle making. The plant belongs to the ginger family, and is known botanically as *Curcuma longa*.

TURN-AND-BANK INDICATOR. When a pilot is flying a machine in clouds, fog, and sometimes at night, he is unable to judge the position of his aeroplane by reference to an external object. Hence he is unable to tell if, instead of keeping his course, he has "banked" his plane and turned into a new course. Owing to the fact that the compass is unreliable unless the plane is flying level, the pilot must have an instrument which will warn him of any tendency to bank and turn. The instrument used embodies a microscope.

TURNER, JOSEPH MALLORD WILLIAM (1775-1851). An English painter, considered by many to be the greatest artist of the English school of landscape painting. His father, a London barber, native of Devonshire, recognized the boy's talent, and encouraged it in every way possible. He taught his son to read, permitted him to neglect regular schooling for art study, and had him enter the Royal Academy in 1789. The next year, when Turner was but fifteen years old, he exhibited his first picture, a view of Lambeth Palace. In 1802 he was elected to membership of the Royal Academy.

Turner was a keen student of Nature, and to obtain material for his pictures was accustomed to go away on long sketching tours.

In depicting natural scenes he aimed chiefly at expressing light and colour effects in the landscape, and, especially after 1840, his whole art was concentrated on the solution of this problem, so that his later oils became merely romantic masses of colour.

Another phase of Turner's activities is exhibited in the production of the *Liber Studiorum* begun in 1807, largely inspired by a desire to emulate the *Liber Veritatis* of Claude. This consists of a series of parts of five plates, each of which contains engravings of historical, mountainous, pastoral, marine, and architectural subjects, done originally in sepia and then transferred on to copper plates, either by Turner himself or by other engravers. Of the complete series of 100 plates 70 were published, the last being issued in 1819.

Turner died in a lodging at Chelsea, where he had sought seclusion in ill health. He was buried in St. Paul's. He bequeathed his valuable collection of paintings, engravings, and sketches to the nation, and this collection may be seen to day in the Tate Gallery and the National Gallery in London.

One of Turner's most popular pictures, "The Fighting Temeraire," is exhibited in the National Gallery. Other famous works are "Wind, Stream and Speed," "Shipwreck," "Sun Rising in the Mist," "Bay of Baiae," and "The Splügen," which depicts the grandeur of Alpine scenery.

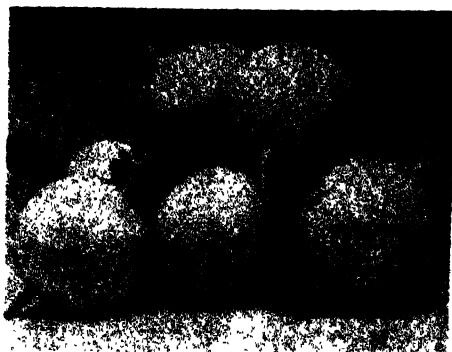
TURNIP. A plant cultivated for its fleshy root, which is used as a table and stock food. It is grown from seed sown successively in spring and summer. The flesh is whitish or yellowish.

Turnips may be stored for winter use in damp earth, sand, or leaves, but a cellar with earth walls and floor makes a good storage house. Turnips are about nine-tenths water and have a low percentage of nutriment. Large quantities of field turnips are fed to stock in Great Britain, Europe, and Canada. The tender growing tops are sometimes used in spring as a green vegetable.

A species known as *swede*, or sometimes *rutabaga*, has a large root of firm flesh, pronounced flavour, and yellow colour. The swede is used as a stock food more extensively than the ordinary turnip, especially



J. M. W. TURNER
Photo Brown Bros.



WHITE TURNIPS
Photo: Sutton & Sons

for sheep. The best swedes are produced in moist climates, such as that of Scotland.

Scientific Names. Turnips belong to the mustard family, *Cruciferae*. The common turnip is *Brassica rapa*; the swede is *B. campestris*.

TURNSTONE. The name applied to a small species of shore bird, with reference to its habit of turning over shells and pebbles with its bill, in search of food. The common turnstone nests only in Arctic regions and migrates in winter to southern shores. It is a bird about 9 in. long, with variegated plumage of black, white, and reddish-brown.

Scientific Name. The turnstones are related to the plovers and belong to the family *Charadriidae*. The common turnstone is *Arenaria interpres*.

TURPENTINE. The resinous sap of various species of pine, being separated as a thick, gummy substance. To obtain it, the bark is cut away with a special tool, and the sap is collected in metal cups and then boiled in a copper vat, the heat causing the turpentine to change into vapour; the vapour passes into a coil of pipe cooled by water, and is there condensed into oil or spirits of turpentine. The part left in the vat forms the resin of commerce.

Oil of turpentine is a yellowish, highly inflammable substance, of strong, peculiar odour and hot, biting taste. It is extensively used as a drying medium in paints and varnishes, for it solidifies when exposed to air. It will dissolve paint stains on clothing. This oil is also coming into general use as a solvent for rubber and other gums in the manufacture of artificial camphor, from which plastics such as celluloid are made.

Medicinally, oil of turpentine is used externally and internally. In the form of a liniment, it is used for sprains or strains, while the oil itself is applied externally in pleurisy and bronchitis. It is an efficient worm-expelling remedy, and is used also for

ulceration of the stomach and intestines. In typhoid fever, it acts favourably, assisting to heal the ulcerations of the bowel, which are characteristic of this fever, and aiding also in the expulsion of gas.

TURPIN, Dick. A famous highwayman, around whose exploits many legends have gathered; was born in Hempstead, Essex, in 1705. At first apprenticed to a butcher, he afterwards entered a career of crime which included cattle lifting, smuggling, and highway robbery. The story of his adventurous ride to York on "Black Bess" to escape justice is a fiction. In 1739 he was captured and hanged at York for the murder of an Epping innkeeper.

TURQUOISE, tur' kwōiz, or tur' kwōis. A semi-precious stone of delicate green or blue shades. In chemical composition, the turquoise is commonly regarded as a hydrous phosphate of aluminum, and the colour is due to the presence of copper or perhaps iron phosphate. The turquoise is the national stone of Persia, where healing power is credited to it.

The stone is found in igneous and volcanic rocks in Mexico, the U.S.A., Persia, Asia Minor, Turkistan, and Siberia. The mines in Persia have been worked for at least 800 years, and produce the finest varieties. Fossil bone, coloured blue by phosphate of iron, which is called *odontolite* or *bone turquoise*, looks very much like turquoise. The turquoise is the birth-stone for December.

TURRIFF. See ABERDEENSHIRE.



TAPPING A PINE TREE FOR TURPENTINE
Photo: Visual Education Service



TURQUOISE MINE IN THE ORIENT
Photo U. S. U.

TURTLE. The turtles constitute an order of legged reptiles of over 200 species. Some live wholly in water, some only on land, and others are fitted to live in either environment. Like other reptile groups, the turtles are found most abundantly in the tropics, the fresh-water forms are the most numerous. Scientists call the order *Chelonia*, but the names *turtle*, *tortoise*, and *terrapin* are commonly used to designate these reptiles. Altogether, the chelonians form one of the most ancient reptilian orders. No species, living or fossil, possesses teeth. The horny-edged jaws, however, are quite capable of biting hard substances.

Owing to the rigid structure of the body in these animals, breathing is not by normal rib expansion. Air is forced into the lungs by a special movement of the floor of the mouth and the expansion and contraction of head and neck.

The short, broad body of the turtle is covered above by the *carapace* and below by the *plastron*, which are joined in such a way that the head, limbs, and tail project through openings. The carapace consists of a series of bony skin plates, attached to and

covering the backbone and dorsal ribs. The lower part is built around the breastbone and ventral ribs. There is an exception in one curious group in which the shell is replaced by a soft leathery covering. These leathery turtles, or leatherbacks, are found mainly in the West Indies. They grow to a very large size and sometimes weigh as much as a ton.

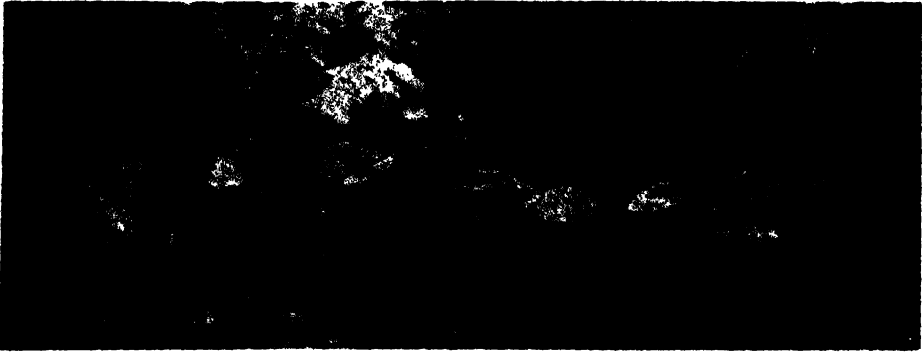
The adaptations of the turtles are most interesting. The land-dwellers are slow and clumsy, and need special protection from their enemies. The bones of the shell are closely united, and the head, legs, and tail can be withdrawn inside the shell when danger threatens. Land tortoises have short, club-shaped feet with blunt claws. They feed chiefly on berries and vegetation, and by nature are docile.

Fresh-water turtles are more active than their land cousins, and have their feet partially or completely webbed. Many of them cannot withdraw the head, legs, and tail within the shell, but their quicker movements make up for the lack of this adaptation. Sea turtles have paddle-shaped limbs, resembling those of whales. In some water species, the bones of the shell are not closely united.

The chelonians all hatch from eggs, which are laid in holes scooped out by the female with her hind legs. These holes may be dug in a sandy beach, in soft ground, or even in the wood of a rotting log. The eggs are well covered, and left to hatch in the warmth of the sun. No care is given the young turtles by their mothers. The eggs and flesh of some species are edible, and the horny covering of one of the sea



BOX TORTOISE
Photo National Education Service



TURTLES SUN-BATHING

Photo: Visual Education Service

turtles furnishes the prized "tortoise-shell" of commerce (see below)

Mud Turtles. These form a group of small aquatic chelonians with mud-coloured shells. They are found in sluggish streams or muddy

with variable yellow markings. This turtle is a voracious eater of berries and vegetation, not disdaining earthworms and slugs.

Tortoises of the Land. Among these the largest are the giant tortoises of the Galapagos and some other oceanic islands. Their shells sometimes grow to be over 4 ft. long, and specimens may weigh as much as 500 lb.

Sea Turtles. The sea turtles are found chiefly in tropical and subtropical oceans, and grow to large size, averaging 3 ft. to 6 ft. in length. The leatherback is at home in the warm parts of the Atlantic and Pacific, and in the Indian Ocean, though it sometimes wanders into the cooler regions. The

leatherback feeds on lobsters, crabs, shrimps, jelly-fish, and other marine prey.

The *green turtle*, so called from the colour of its fat, is notable in that it feeds on



A MATÁ-MATÁ (SNAPPING) TURTLE

Photo: Booth Lunas

rivers. Though rarely as long as 5 in., when molested they snap and bite viciously.

Terrapin. This name has no exact scientific meaning. It is applied to various pond, salt-marsh, and river turtles of aquatic and semi-aquatic habit. Musk terrapin and mud terrapin are names used in America interchangeably with musk and mud turtle. The painted terrapin or pond turtle is about 6 in. long, and when full-grown weighs about a pound and a half.

Box Tortoise, or Box Turtle. These names are applied to a group of turtles that can shut themselves securely inside their shells. The carapace and plastron are joined by a piece of elastic cartilage, and the plastron is divided in the centre by a hinge. When menaced, a box turtle can draw the front and back sections of the plastron up against the top shell, and conceal itself inside a box that is extremely difficult to pry apart. Structurally, these chelonians are allied to the water turtles but are, in fact, land-dwellers.

The carapace is between 5 in. and 6 in. long, and black or dark brown in colour,

vegetable matter, and its flesh is edible and well flavoured. This is the turtle that is used for making turtle soup. It is distributed through all warm seas. Very large specimens weigh as much as 500 lb.



UNDERSIDE OF MUD TURTLE

Photo: Visual Education Service



RESULTS OF A TURTLE HUNT IN THE SAMOAN ISLANDS

Photo. OROC

The *hawksbill* is a small sea turtle from whose carapace *tortoise-shell* (see below) is obtained.

Tortoise-shell. A beautiful, partly transparent substance used in inlay work and in making combs, boxes, buttons, spectacle rims, and various ornamental objects. It is obtained from the horny plates covering the carapace of the hawksbill turtle.

Genuine tortoise-shell takes a high polish, and is marketed in various shades of brown, variegated with patches of clear, amber yellow.

Classification. The order *Chelonia* is divided into two sub orders, as follows: *Athecae*, the leatherback; and *Phocophora*, all other turtles. The snapping turtles compose the family *Chelydridae*; the musk turtles, *Kinosternidae*. The terrapins described in this article, the box turtles, and the land tortoises belong to the family *Testudinidae*. The leatherback belongs to the family *Sphargidae*; all other sea turtles to *Cheloniidae*.

TURTLE-DOVE. See DOVE; PIGEON.

TUSCANY. A department of Italy, and formerly a sovereign state. It lies west of the Apennines in northern peninsular Italy, and has an area of 8853 sq. miles and a population of nearly 3,000,000. The country slopes down westward to the sea from a mountainous interior. The valleys and

lower ground are well watered and fertile, but the coast regions tend to be swampy. Wheat and vines are cultivated. The ancient



prosperity of Tuscany is reflected by the fame of its towns, Florence, Leghorn, Pisa, Siena, etc. Tuscany became part of the kingdom of Italy in 1860.

TUSSOCK MOTH. See **MOTHS.**

TUTANKHAMEN, *toot ahnk am' men*. King of Egypt, twelfth ruler of the eighteenth dynasty, who reigned about 1359-1350 B.C.



KING TUTANKHAMEN

Profile of a statue in the Museum of Cairo

Photo: OROC

After 3300 years, his tomb was opened on 26th November, 1922, by Howard Carter, the British Egyptologist, and the Earl of Carnarvon.

The king was about eighteen years old when he died, and had reigned for ten years,

having succeeded to the throne at the age of 8. He was the son-in-law of Amenhotep IV, or Akhenaten, the monotheist Pharaoh. Amenhotep overthrew the orthodox state religion of Amon to worship one god only, namely Aton, the disk of the Sun. He accordingly changed his name from Amenhotep to Akhenaten, or Ikhnaton. Tutankhamen was at first a worshipper of Aton, and called himself Tutankhaton. But when he became ruler (about 1359 B.C.), the powerful Amonite priesthood forced him to re-adopt the old worship. See **EGYPT, ANCIENT.**

TWAIN, MARK (1835-1910). The *nom de plume* of an American humorist and author of *The Adventures of Tom Sawyer*, *Huckleberry Finn*, and other favourite boys' books. His real name was Samuel Langhorne Clemens. In early life he was successively typesetter in a printing office and steamboat pilot on the Mississippi. Later, he became a newspaper reporter and editor of the *Buffalo Express*, gradually acquiring a reputation as a writer and lecturer. He also wrote a number of satiric works, including *A Connecticut Yankee at King Arthur's Court*, as well as a few more serious books, such as *Life on the Mississippi*.

TWEED. A rough, rather coarse, woollen fabric which originated in Scotland and gained immediate popularity because it offered a variation from the plain-coloured and even-textured broadcloth used almost exclusively for men's suiting. The best quality tweeds are made entirely of wool. In inferior kinds, mixtures of cotton and shoddy are frequently introduced. Plain, twill, or herringbone twill are the principal weaves, and the colours were originally inspired by the heather and grasses characteristic of the Scottish moors. Single yarns are used in both warp and weft, although there may be variations often resulting in a novel design. Tweed is a very durable fabric, and it is suitable for both men's and women's apparel, especially for outdoor and sports wear. The name "tweed" is said to be derived from



THE MUMMY OF KING TUTANKHAMEN OF EGYPT IN THE MUSEUM OF CAIRO

Photo: U. & U.

the Scottish word "tweel" which was misread as "tweed" when it first appeared on an invoice. Tweel is the equivalent of twill in English.

TWEEDSMUIR, JOHN BUCHAN, 1ST LORD (born 1875). A Scotsman, he was educated first at Glasgow University and then at Brasenose College, Oxford, where he had a



LORD TWEEDSMUIR

Photo: Photopress

distinguished career and was President of the Union. He was called to the Bar in 1901. During the South African War he was one of Lord Milner's private secretaries. He became a partner in the publishing firm of Thomas Nelson & Sons in 1907. In the same year he married Miss Susan L. Grosvenor, and has three sons and one daughter.

His home is at Elsfield Manor, Oxford.

During the War he was on Sir Douglas Haig's Headquarters Staff until 1917, when he was appointed Director of Information at home under the War Cabinet. He retired from publishing in 1929, and since 1927 has sat in Parliament as Conservative Member for the four Scottish Universities.

Mr. Buchan is the author of many well-known novels, and he has also written a *History of the Great War*, and biographies of Montrose, Sir Walter Scott, and Oliver Cromwell. In 1934 he became Lord High Commissioner to the General Assembly of the Church of Scotland. In 1935 he was appointed Governor-General of Canada.

TWELVE TABLES. The code of laws drawn up at Rome in 451-449 B.C. by the *decemvirs* appointed for the purpose. One of its main objects was to assert and define the civic rights of plebeians. The *XII Tabulae* clarified the principles of customary law, separating it from religious sanctions, and became the basis on which the later system of Roman law was developed.

TWICKENHAM. A Borough of Middlesex, eleven miles from London, with which it is connected by the Southern Railway. It had a population of 39,909 at the 1931 census. This Thames-side town has many natural beauties, and many famous people of history have had residences there. York House, now the Council Offices, is a mansion connected with King James II, who resided there some years before his accession. Kneller Hall (1709) is now the home of the

Royal Military School of Music. Other famous residences are Twickenham Park House, owned by Francis Bacon and afterwards by the Berkeleys; a mansion called Strawberry Hill, where resided Horace Walpole; and Pope's Villa, the home of Alexander Pope at which many famous men of letters stayed. Pope was buried in the Parish Church of St. Mary.

TWILIGHT SLEEP. See ANAESTHETIC.

TWILL. The name of a weave or of a fabric. A twill fabric is one in which there is an interlaced effect running in a diagonal direction across the piece. The line may run from left to right, or right to left. Harvards, cashmeres, and serges are well-known twill fabrics.

TYCHE, ti' ke. The Greek name for the goddess of chance, Fortuna of the Romans.

TYLER, JOHN (1790-1862). An American statesman, tenth President of the United States. He was elected as Vice-President, with William Henry Harrison as President, but the latter's death in 1841, soon after his inauguration, elevated Tyler to the Presidential chair. The principal events of his administration were the Webster-Ashburton treaty, the admission of Florida to statehood, and the annexation of Texas.



JOHN TYLER

Photo: U. S. U.

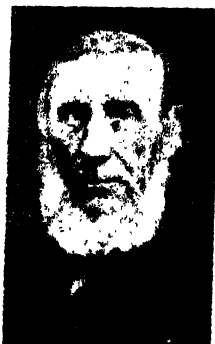
TYLER, WAT.
See RICHARD II.

TYNDALE, tin' dāl, WILLIAM (c. 1484-1536). An English disciple of Luther and a translator of the Bible; born in Gloucestershire and educated at Oxford and Cambridge, where he came under the influence of Colet and Erasmus. Before long he threw in his lot with the reformers and went to Germany, where he visited Luther. His translation of the New Testament was printed on the Continent and smuggled into England. The clergy took alarm and ordered that all the copies of it found should be burnt (1526). In 1530 Tyndale issued a translation of the *Pentateuch*; in 1531 a revision of the *Book of Jonah*; and in 1534 a revised edition of his New Testament.

Meanwhile, he entered into the theological controversy with Sir Thomas More which has left us two great controversial works, More's *Dyalogue* and Tyndale's *Answers*. He was finally betrayed into the hands of his enemies and burnt as a heretic at Vilvorde

on 6th October, 1536. He did much to establish the principles of the English Reformation. His translation of the New Testament, which is based primarily on Erasmus's edition of the Greek text, was largely incorporated into the Authorized Version.

TYNDALL, *tin' dāl*, JOHN (1820-1893). A British natural philosopher and physicist, born in County Carlow, Ireland. His early



JOHN TYNDALL
Photo. Brown Bros.

investigations in magnetism resulted in his election in 1852 as Fellow of the Royal Society. In 1854 the Royal Institution made him professor of natural philosophy, a colleague of Faraday, and appointed him director on the latter's death. As scientific adviser to Trinity House and the Board of Trade, he carried out many experiments. His chief scientific work

was connected with the study of radiant heat, its transmission and radiation, and its absorption by vapours and gases. Other experiments with pure air led to improved methods of sterilization.

His works include *Heat as a Mode of Motion*, *The Forms of Water*; *Lectures on Light*; *On Sound*; and *Molecular Physics*.

TYNEMOUTH. This County Borough and seaport of Northumberland, with a population of 64,913 (1931), is situated on the north bank of the River Tyne. It is served by the L.N.E.R., and is 133 miles from Edinburgh. The County Borough includes the holiday resort of Tynemouth, the industrial centre and seaport of North Shields, with Percy Main, Preston, Chirton, Howdon, and Cullercoats. Tynemouth occupied a strategic position in the wars of the past; its history goes back through the Normans, Saxons, Danes, Romans, to the ancient Britons. Discoveries point to the occupation of the site now occupied by the ruins of the Castle and Priory by the ancient Britons. A monastery was founded in the seventh century; the present remains are those of a twelfth-century edifice; it was in regular use until 1668. The Parish Church (1792) is of hewn stone. From Tynemouth to Cullercoats Bay is a mile of sands, with all the attractions of a modern holiday resort. North Shields is an important seaport; the fish trade is very profitable. Among the many other industries of the town should be mentioned engineering, the making of ice,

nets, wire rope, nautical instruments, cooking apparatus, biscuits and boxes.

TYNE, RIVER. See NORTHUMBERLAND.

TYNWALD. The independent Parliament of the Isle of Man, consisting of two Chambers—the Governor and his Council of ten and the House of Keys, comprising twenty-four elected representatives of owners and occupiers of property in the Island. After a Bill has passed both Houses it is signed by all the members before it is submitted for



TYNWALD CEREMONY, ST. JOHN'S
The Archdeacon of Sodor and Man and the Just Deemster promulgating the laws in Manx and English. Note the rush-strewn path.

Photo. Isle of Man Publicity Board

the Royal Assent. But before the Act becomes law, it must be read in English and Manx from Tynwald Hill near St. John's before twelve months have elapsed; 5th July is "Tynwald Day," the occasion of the annual promulgation of new legislation.

TYPE. A raised letter or character cast in metal or carved in wood, and used in printing. Printers once carved their own type from blocks of wood, and later cast them in metal, but typefounding is now an important industry. The type commonly used is a slender, rectangular block of metal ninety-two hundredths of an inch high, carrying a raised letter or other character on its top, or face (*f* in the diagram overleaf). A nick on one surface (*n*) indicates how the type should

be set; a groove along the bottom (*g*) allows the type to stand on two "feet" and gives it more steadiness.

Founding. The first step in casting type is to shape a model of the letter desired. This model, or die, is of steel, and when it has been finished, it is stamped into soft copper, leaving an impress of the letter. This soft copper then becomes the mother type or

matrix, from which an indefinite number can be struck off. The matrix is placed in a mould having the shape and size of the finished type, and melted type metal is run in and allowed to harden. The metal used is an alloy of lead and antimony, with a little copper and tin added.

A complete assortment of type of any given size is called a *joint*. The printer arranges his type for convenience into upper and lower cases. The upper case contains compartments for the capital

letters, small capitals, and signs, and in the lower case the small letters, figures, and spaces are kept.

Sizes. Thirteen sizes of type are in common use in printing books and newspapers. The size of type is indicated either by a special name or by the number of *points* it measures, a point being one-seventy-second of an inch. The sizes most in use are the following—

Grand	8 point
Nonpareil	8 point
Minion	7-point
Brevier	8-point
Boutgeois	9-point
Long Primer	10-point
Small Pica	11-point
Pica	12-point

An *em* is the square of the face depth of any particular size of type, and is used as a basis of measurement of type areas. See PRINTING.

TYPES OF SOLDIER. Different countries have produced types of soldier, originally peculiar to themselves, later copied in other armies; the following include some of those serving in the British and Dominion Armies, or in European countries.

Dragoon, drá goon', a soldier formerly

armed and equipped to fight both on foot or on a horse—the original mounted infantryman—then converted into heavy cavalry; probably the best-known dragoon regiment is the Scots Greys. Dragoons were often used to quell insurrections, and quartered, as a penalty, upon the inhabitants of a disaffected district—hence the term *to dragoon*, meaning to force a person to do something against his will.

Engineers, soldiers trained to construct and maintain roads, bridges and railways in war-time, to make obstacles and permanent fortifications, and to carry out demolitions and mining operations for blowing up enemy works. In peace, they are chiefly employed in building and upkeep of barracks.

Franco-Tireur, frahn le rur' (*Free Shooter*), a civilian in France during the 1870-71 campaign, who took up arms against the Germans, but did not wear uniform. If captured, he was liable to be shot.

Fusilier, fúz i eer', a soldier originally armed with a *fusil*, or short musket, and wearing a conical cap of bearskin; now only an honorary title of distinguished line regiments.

Guides (Corps of), a distinguished body of Indian troops, comprising cavalry and infantry, originally raised for service on the frontier of India.

Hussar, hu zar', with the lancers, the light cavalry of Napoleonic wars, employed on reconnaissance ahead of the army and for pursuit. Hussars were originally Hungarian cavalry, but the name is derived from a Slavonic sobriquet for the horsemen of Matthias Corvinus in the fifteenth century.

Life Guards and Horse Guards form the Household Troops in close attendance upon the Sovereign; both the Royal Horse Guards (Blues) and Life Guards wear breastplates or cuirasses in full dress.

Light Infantryman, lightly armed and equipped foot soldiers used for speed, or to skirmish ahead of the heavy infantry columns; latterly simply a title of distinction to certain line regiments.

Rifleman, very similar in equipment, tactics and handling to the light infantryman, but dressed in some shade of dark green or black; rifle regiments carry no colours, but display their battle honours on their pouches in full dress; they march past at the "trail." See also GRENADIER.

TYPEWRITER. Typewriter history dates back to the days of Queen Anne when, in 1713, Henry Mill, a British engineer, was granted a patent for his invention of a machine "for the impressing or transcribing of letters singly or progressively one after another as in writing." Progress in the development of the idea during the two



SINGLE TYPE

Explanation appears in the text.

and a quarter centuries since the date of its birth may appear to be slow, but in actual fact it was not until the year 1873 that the first commercially successful typewriter was manufactured. During the intervening years various people worked upon the idea of mechanical writing, but few of the attempts were sufficiently practical to be regarded as important. The most noteworthy invention of this period was that produced by William A. Burt of Detroit, in 1829.

Development of the Modern Typewriter. With the entry into the typewriter invention field of Christopher Latham Sholes, however, 150 years after the birth of the idea, the birth of the typewriter may be said to have been accomplished. After many years of experiment, C. L. Sholes produced a machine, known as the Sholes & Glidden machine, which attracted the attention of the firm of E. Remington & Sons. This was followed by the first Remington Typewriter in 1873, and with this machine the typewriter industry may be said to have been created. Apart from many valuable improvements in action and in devices, two main changes have been introduced since the production of the first commercially successful typewriters. The first of these is the provision of visible writing—a feature made possible by the introduction of the front-stroke type-bar action. Although this was an idea of much earlier introduction, a machine built on these lines was first successfully marketed by the Underwood Elliot Fisher Company (then the Underwood Typewriter Company) in 1898. This machine was the prototype of most of the machines of to-day. The other main change—but in no sense universally adopted—was the introduction of "noiseless" machines. Whilst many improvements have been made in the direction of quieting the action of the majority of ordinary type-bar machines, the "noiseless" machines are distinguished from this main group by the attempt that has been made—and developed to a highly successful degree—to eliminate practically all noise of operation. This has been made possible chiefly by the substitution of type-bars working on what might be termed a "push" action instead of a "strike" action, whereby the type is caused to be pressed against the ribbon instead of striking it.

Considerable attention has also been given to electrically driven machines, and although this idea has not been adopted universally so far as correspondence machines are concerned, it forms the basis of most accountancy typewriters.

Typewriter manufacture is largely an industry of the United States of America, but it is interesting to note that in Great

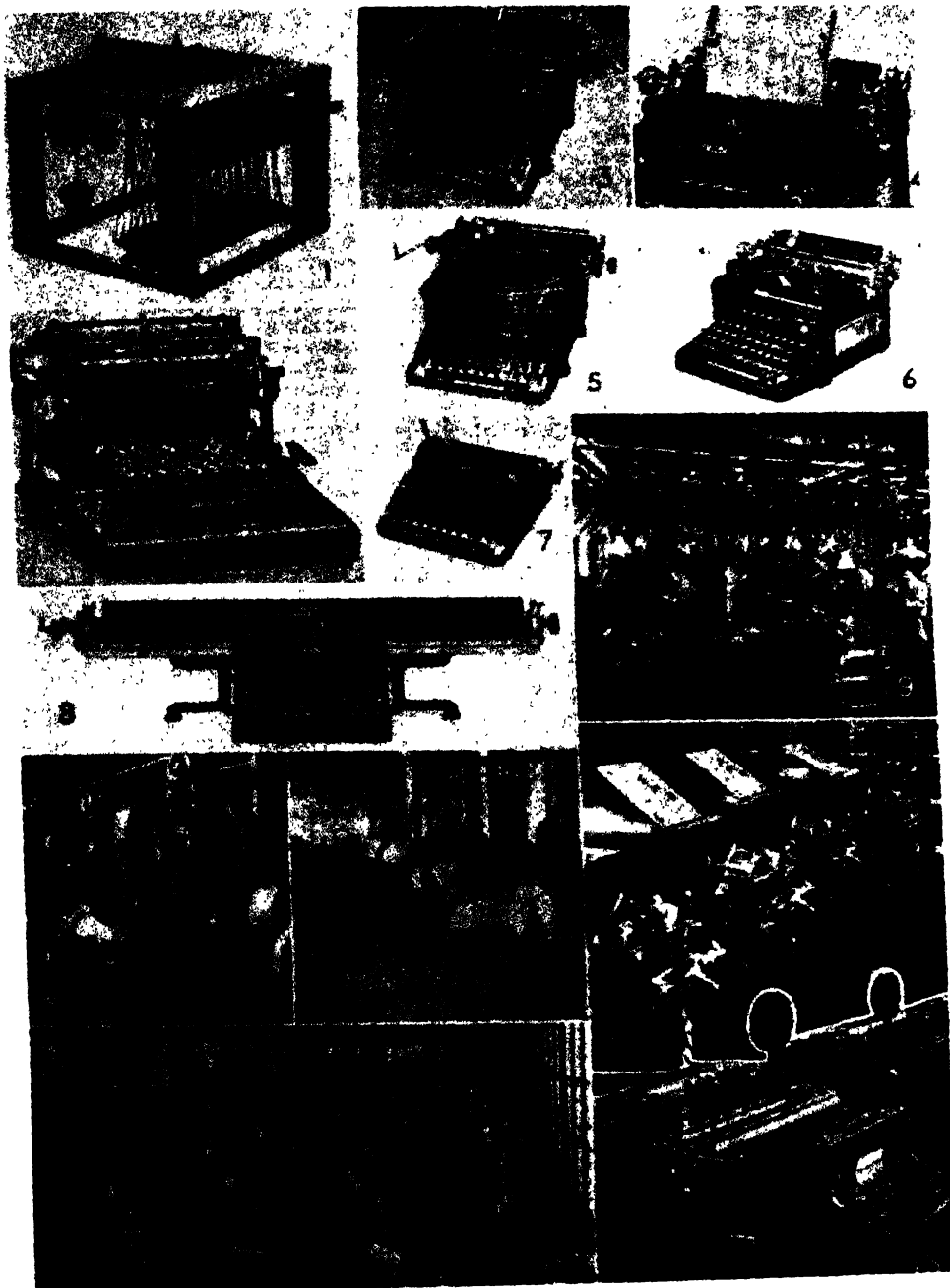
Britain there are no less than four manufacturers engaged in the production of British machines, namely the Bar-Lock, the British Empire, the Imperial and the Oliver.

Standard Machines. Under the term "standard" are included those types of machines in which certain features are identical, as distinct from "non-standard." These features are, principally, the provision of a four-bank keyboard (i.e. a keyboard arranged in four lateral rows of keys); the arrangement of the keyboard in a practically identical order of letters (little changed, by the way, since the order adopted by Christopher Latham Sholes in his first Remington); a single shift operation for capitals and additional characters; and visibility of writing. Non-standard machines may differ in that the type mechanism may be other than the front up-stroke type-bar action; the keyboard is arranged in three rows of keys, with three characters or type to each key instead of two, necessitating a double shift key instead of a single shift. And, in addition to these things, the construction of the machine is frequently different, either in design, mechanical operation, or manipulating devices.

The term "standard" machine is used also to distinguish between the main type of office machine and the "portable" machine. The increased manufacture of portable machines of all kinds has gone far to stimulate the use of the typewriter in the home.

Side by side with the improvement in the construction of the typewriter, there has been, especially during the past twenty years, great improvement in typewriter operation and in the methods of training the operator. Trained on modern lines, such as those employing carefully devised gramophone records for the establishing of correct timing of key depressions and consequently accurate operation, typists reach a normal speed of 80 words a minute. The average speed of the typist in the office is regarded as from 40 to 50 words a minute. Trained champion typists reach an average net speed of 125 words a minute, whilst the World's Typewriting Record was won with 135 words net a minute, by George L. Hossfield in 1929, on an Underwood machine.

TYPHOID FEVER, also known as ENTERIC FEVER. A specific disease caused by the *bacillus typhosus*, a micro-organism. When these germs gain access to the small intestine they set up patches of inflammation in its mucous membrane from which poisons are absorbed into the system, giving rise to the symptoms of the disease. These appear, as a rule, very gradually; the patient feels vaguely ill, with headache and pains in the



THE TYPEWRITER

1. Writing machine patented in 1866. The weight on the left moved the carriage. 2. Double keyboard blind writing machine of 1889-1895. 3. A standard Underwood machine. 4. Index card holder attachment in use. 5. A Standard Noiseless machine. 6. A Standard Royal machine. 7. A noiseless portable. 8. Typewriter fitted with the longest carriage made; paper 33 in. wide can be inserted. 9. Machine room where typewriter parts are manufactured. 10. Power presses used to make typewriter bodies. 11. Rough cast parts are rotated together in these drums to smooth off their edges. 12. A modern repair department. 13. Mechanical exercises: (above) type bars exercised by mechanical fingers; (below) exercising carriages. New typewriters require this treatment so that all necessary adjustments can be made before they are marketed.

Photos: Imperial: Royal. Underwood

limbs, and perhaps diarrhoea. The temperature slowly rises, until in a week it may be 103° or 104° ; at that level it remains until the tenth or fourteenth day, during which stage the patient is dull and apathetic and obviously very ill. After the first week a rash consisting of rose-pink spots is seen on the abdomen and chest, often spreading to other parts. In a mild case improvement begins at the end of about two weeks, and convalescence is gradually established. In fatal cases death occurs either from the disease itself, or from such complication, as haemorrhage from the bowel, perforation of the intestine with acute peritonitis, or pneumonia. The treatment is mainly directed to combating the symptoms as they arise, an important part being frequent or continuous sponging to reduce the temperature. Prevention is achieved by the injection of vaccines in those who are likely to be exposed to the infection. Many other precautions are now taken, such as the chlorination of drinking water, sewage disposal, etc. See PARATYPHOID.

TYPHOONS. Circular storms with a very high speed of wind movement. They occur in the Indian Ocean and China Seas on fairly well-defined courses during the change of monsoons. They may, however, occur at other seasons. Typhoons do enormous damage on land and to shipping.

TYPHUS, ti'fus, FEVER. A contagious disease transmitted from person to person

by means of lice. It is also known as *jail fever* and *spotted fever*, with reference to its occurrence in prisons, and because of a characteristic eruption that appears in the course of an attack. Typhus fever is little known in Britain.

An attack comes on suddenly, and is manifested by rise of temperature, severe nervous symptoms, rheumatic pains, head ache, and rigour of the muscles. About the fifth day of the attack, slightly raised spots appear on the body; at first, these disappear when pressed, but later they become permanent and darker. During the second week, the patient usually becomes delirious, and about the fourteenth day, the attack reaches a crisis. In favourable cases, recovery follows rapidly.

Treatment of typhus victims is mainly along hygienic lines. Patients are isolated and are given clean surroundings, and their clothing is disinfected or sterilized. By this means, lice and eggs are destroyed. Fever, headache, and delirium are controlled by ice packs, baths, etc., and certain drugs are also administered which act as stimulants and laxatives. One attack usually protects the victims from a recurrence of the disease.

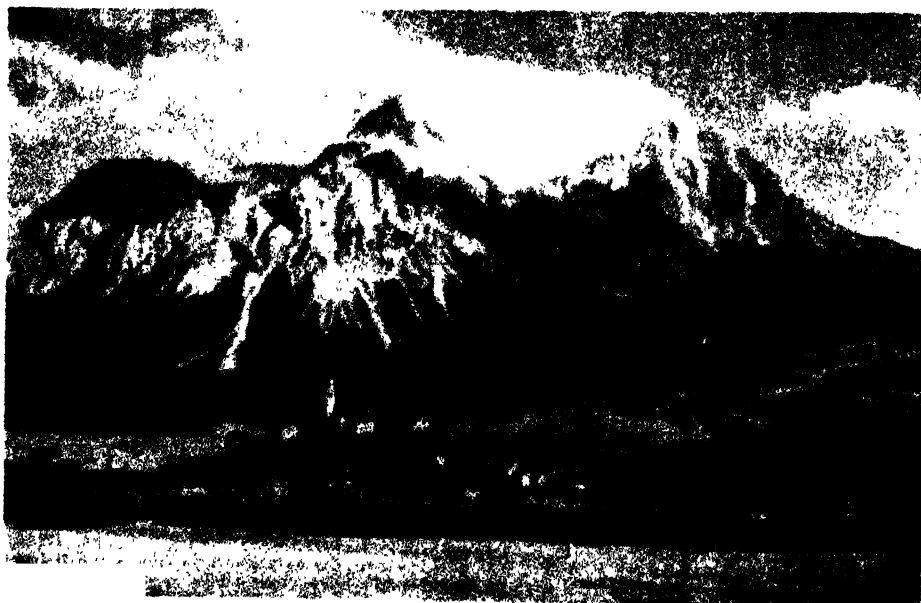
TYR. The Norse god of war. See TUESDAY.

TYRE. See PHOENICIA.

TYRES. See PNEUMATIC TYRES.

TYRIAN PURPLE. See PURPLE.

TYROL, tir'rol (Ger. *te rol'*). Before the World War, a crownland of the Austrian



THE VILLAGE OF LERTHAUS IN THE AUSTRIAN TYROL

Photo: Austrian State Travel Bureau

Empire, noted for its Alpine scenery; by terms of the Treaty of Saint-Germain, 1920, Northern Tyrol was retained by Austria, which became a republic, and Southern Tyrol was ceded to Italy.

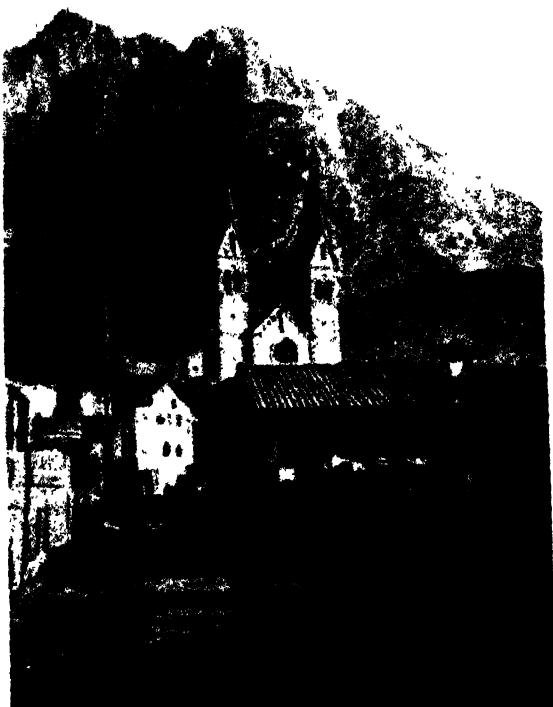
Austrian Tyrol. The territory left to Austria, constituting a province of the republic, lies between Vorarlberg on the west and Salzburg on the east. It has an area of 4882 sq. miles, and a population of 349,100. Innsbruck, the capital and largest city, is described in these volumes under AUSTRIA.

Italian Tyrol. The part ceded to Italy extends south from the Austrian frontier and eastward from the Swiss border about 100 miles along the River Adige. It is divided into two districts: Alto Adige in the north, and Trentino in the south. Trentino has an area of 2454 sq. miles and Alto Adige 2953 sq. miles.

During the World War, in April, 1915, when Italy was still associated with Austria in the Triple Alliance, the Italian government demanded Trentino and certain territory northward. Austria having refused to cede anything besides Trentino, Italy in May concluded the Treaty of London with the Allies, and entered the war on their side. The peace treaty at the close of the war permitted Italy to annex a section predominantly German. In Alto Adige there are about 116,000 Germans and 22,500 Italians and Ladins (people using a Romance dialect). In Trentino there are approximately 13,450 Germans and 361,000 Italians and Ladins.

TYRONE, EARLS OF (Conn O'Neill (1480-1559) was created first Earl of Tyrone by Henry VIII in 1541. He was a member of the celebrated Irish family of O'Neill, descended from Niall, a fifth century king of Ireland (Henry O'Neill had been acknowledged chief of the Irish kings by Henry VII in 1463.) The second earl of Tyrone was Hugh O'Neill (1540-1616). He was the second son of Matthew, held to be the illegitimate son of the first earl. He had con-

stant disputes with his kinsman Turlough, but eventually became supreme in the north. He incurred enmity by eloping with the sister of Sir Henry Bagnal and sought aid from Spain and Scotland. He was formally pardoned by Queen Elizabeth only to resume fighting. After suffering defeat when



AUSTRIAN TYROL
Photo: Austrian State Travel Bureau

allied with a Spanish force, he submitted, ignorant of the death of the Queen. At first he thought of going to James in London, but decided to fly the country. The importance of the O'Neill family declined in the eighteenth century, though a branch of the family settled in Portugal and became Portuguese nobles. In 1855 the male line in Ireland became extinct.

THE WORLD BOOK

Uu

U is the twenty-first letter of the English alphabet. There was no corresponding letter in the Phoenician alphabet, but when the Greeks adopted the Phoenician system, they added a letter, called *upsilon*, which was pronounced like the English *oo*. It was written at first either like a capital *V* or a capital *Y*, but gradually the latter came to be used almost exclusively by the Greeks, while the Romans used the *V*. The sound in Greek also changed by degrees to one that resembled the French *u*, and was more like a long *e* than anything else in English; and the Romans took over the *Y* form to represent this new sound. The *V* in early Latin had usually the vowel sound, but at the beginning of words, it had a consonant force, like the English *W*, and in time the rounded form *U* came to represent the vowel sound, while the angular form stood for the consonant. In English, when the *V* sound was introduced, a new letter was necessary, and *W* was added.

U-BOAT. An abbreviation in common use during the World War for *Unterseeboot*, the German name for a submarine (which see).

UDALL, NICHOLAS (1505-1556) Udall was educated at Oxford and became headmaster of Eton College in 1534. It was probably while he was headmaster of Eton (i.e. between 1534 and 1541) that he wrote the play by which he is remembered, *Ralph Roister Doister*, to be acted by his pupils. This play, which is modelled on the Latin comedies, is one of the earliest English secular comedies.

UGANDA, u' gan' da. A British protectorate in East Africa, lying between Kenya Colony on the east and Belgian Congo on the west. It is made up of several native states ruled nominally by their own kings, who are encouraged by the British to conduct all their local affairs. General administrative power is vested in a governor, assisted by legislative and executive councils.

The total area is 94,204 square miles. Of this area, 13,610 square miles are water, for within the boundaries of the protectorate lie portions of Victoria Nyanza, and Lakes Albert and Edward, and all of Lakes George, Kioga, and Salisbury. The population is estimated at 3,640,636 (1934), of whom about 15,000 are Asiatics and nearly 2000 are Europeans. Over a fourth of the natives

are civilized Baganda tribes, after whom the protectorate is named. Educational facilities are being constantly extended, and about 250,000 children attend school.

Except in the north-east, the soil is generally fertile, and produces a variety of tropical products. Climate varies little throughout the year and is warm with two rainy seasons. Plantains, sweet potatoes, millet, cassava, peas, and beans are grown extensively as food crops, and cotton, tobacco, coffee, and sugar are raised for export. Tea and rubber are grown. Large herds and flocks of cattle, sheep, and goats are the source of a prosperous export trade in hides and skins. Ivory, tin ore, and a little gold are also exported.

Entebbe is the seat of British administration. Kampala is the centre of trade, and is connected with the Kenya railways. The protectorate has good motor roads, and steamer service on the chief lakes. The air route between London and Cape Town serves Uganda.

UKRAINE, u' krayn. An autonomous republic occupying the south-western corner of the Russian plain. It is known officially as the Ukrainian Soviet Socialist Republic, and is a constituent state of the Union of Soviet Socialist Republics. The area is 166,368 sq. miles and the population is 31,901,400 (1933), most of whom live by agriculture.



UGANDA

Native dwelling. 2. Ankole cattle. 3. Native jester at a chief's wedding festivities. 4. Chief with his wives and attendants. 5. Natives in ceremonial dress.

Photos: H. M. East African Dependencies

The rich black-earth region of Europe extends through the Ukraine, and wheat, rye, oats, maize, sugar-beet, tobacco, potatoes, and hemp are profitable crops, except in drought years. Cattle-breeding is an important occupation, and manufacturing is on the increase. The Republic is well supplied with railways, and air lines are rapidly being developed.

The Donetz basin produces 75 per cent of the coal of the Soviet union. There are also large deposits of iron ore and manganese ore. The Dnepropetrovsk dam on the Dnieper river produces a great quantity of hydro-electric power which is leading to extensive industrialization, especially at Dnepropetrovsk (population 379,000).

The Ukrainian towns of greatest importance are described below:

Kharkov, *kar' kof*, situated 420 miles south-west of Moscow, has good railway facilities. It was made the capital of the Ukrainian S.S.R. in 1920. Industries are chiefly connected with the manufacture of iron and steel products, south of Kharkov, in the Donetz coal basin. Near-by is a large salt mine. Population, 654,000 (1933).

Kiev, *ke' yef*, the capital of the republic,

was founded in 864, and is the oldest of the famous cities of Russia. It is on the right bank of the Dnieper, 670 miles south of Leningrad. Population, 538,500 (1933).

Odessa, *o des' a*, one of the busiest cities of Russia, and an important seaport. It lies on the Black Sea, thirty-two miles north-east of the mouth of the Dniester river. In 1926 Odessa was made a free port. Odessa is a wheat port and an active industrial centre, the salt works being especially important. Other establishments include plants for the manufacture of glass, brick, machinery, cork, glue, and oil. Factories for the production of moving-picture apparatus and aeroplanes have also been established. Population, 497,000 (1933). Other towns are Kherson, a grain and timber port, closed by ice for three months of the year, Nikolager, Mariupol and Berdiansk.

UKULELE, *u' kē lay le*. A small, four-stringed plucked instrument, which originated in Hawaii and was introduced into America by Hawaiian singers. It is not of native inception, however, as the first ukulele was designed by a white man who used the Portuguese "taro-patch fiddle" as his model. The best instruments of this type are made of

koa, a wood found in the Hawaiian Islands, but reproductions in mahogany or inferior wood are common.

The *natural C* tuning arrangement is usually followed, with the four gut strings tuned to play *A, E, C, and G*, but a higher tuning results in a brighter tone. After enjoying great popularity for a few years the ukulele has become virtually extinct.

[The name *ukulele* is derived from a Hawaiian word meaning flea, or "jumping insect."]

ULCERATION. See INFLAMMATION.

ULNA. See ARM.

ULNAR NERVE. See FUNNY BONE

ULSTER. One of the four ancient provinces of Ireland, now comprising the counties of Londonderry, Antrim, Down, Armagh, Tyrone, Fermanagh, Monaghan, Cavan, and Donegal. The three last-named counties are included in the Irish Free State; the others together form the separate territory of Northern Ireland. The population of Ulster is a little over 1,500,000, and its area is approximately 5,200,000 acres.

Physical Features. Nearly the whole of Ulster lies to the north of the great limestone plain which occupies the centre of Ireland. The geography of Ulster falls into three main divisions, the River Erne and its lakes in the west, the valley of the Foyle in the north, and Lough Neagh, the largest lake in Ireland, with its group of rivers in the east. The Erne rises in the centre of Ireland and flows through a string of lakes, of which the biggest are Upper and Lower Lough Erne, curving to the west, the river reaches the sea at Ballyshannon on Donegal Bay, where there are splendid waterfalls. To the north of the Erne, as it flows seawards, rise the mountains of Donegal, a wide expanse of high country with two considerable peaks, Slieve Donard (2219 ft) and the Blue Stack (2216 ft). The coast of Donegal is very rugged, with numerous bays and islands. One of the deepest of these bays, in the extreme north, is Lough Swilly, which penetrates far back into the heart of the country. Between this bay and the deep landlocked gulf of Lough Foyle, farther away to the east, juts out the hilly peninsula of Inishowen. Lough Foyle is the estuary of the River Foyle, which threads its way down to the sea between the mountains of Donegal and the Sperrin and Carrtoher Mountains of Co. Londonderry. These last-named mountains form the backbone of Ulster. The Donegal mountains in the west are balanced by the high Plateau of Antrim on the east coast, and between this plateau and the central ridge lies the plain of which Lough Neagh, with its rivers the Bann and the Blackwater, is the dominant feature. The east coast is less rough than the west, but

is likewise indented with deep landlocked bays, one of which is Belfast Lough, on which stands the Northern Irish capital of Belfast.

History. At the beginning of the Christian Era, Ulster was one of the five principal kingdoms into which Ireland was divided. The capital city at that time was Emania, near Armagh. In the second century A.D. the kings of Connaught began the movement eastward which led to the establishment of the new dynasty of Tara (see CONNAUGHT). As the conquests of the Tara kings continued, the territories of Ulster were gradually brought under subjection, and under their new rulers became known for a time as Oriel. In the fifth century the O'Neills, of the ruling house of Tara, completed the subjugation of Ulster and established their capital at Ailech, near Londonderry. Meanwhile Christianity had come to Ireland brought by Saint Patrick, who made Armagh his metropolitan see. At the English invasion, in the twelfth century, a large part of Ulster, owing to its remoteness, was able to maintain its independence. As late as the sixteenth century the O'Neills were recognized as kings of Ulster. But at the end of Queen Elizabeth's reign a determined attack was made upon Ulster, and in spite of Spanish aid the Ulster forces were finally defeated. Large tracts of land were confiscated and planted with colonists from England and Scotland, a process which was later repeated by Cromwell. These colonists were Protestants, and in the struggle between William III and James II they supported the Protestant William against the Catholic James, from which fact they became known as "Orangemen." Since that time the breach between Ulster and the rest of Ireland has remained constantly open, as is shown by the present political division of Ireland into the Free State and Northern Ireland.

Agriculture and Industries. Although Ulster is generally thought of as the principal industrial area of Ireland, in fact by far the greater part of the people of Ulster are employed in agriculture. The industries, chief among which are shipping and shipbuilding and the manufacture of linen, are concentrated at Belfast and Londonderry and a few other towns.

Chief Towns. The chief towns of Ulster are Belfast, Londonderry, Armagh, Enniskillen, Downpatrick, Monaghan and Omagh, on each of which a separate article will be found in this work.

See IRELAND (Northern Ireland).

ULSTER, EARLS OF. This title was in 1181 conferred by Henry II on John de Courcy (d. *circa* 1219), who in 1185 became



ULSTER

1. Holystone at Doagh, Co. Antrim 2. Old Gate, Carrickfergus 3. Round tower at Antrim
4. Setting the early potato crop at Newtownards, Co. Down

Photos: Fox

deputy to Prince John, Lord of Ireland. In 1204, with the help of his brother-in-law, the King of Man and of the Isles, he defeated Hugh de Lacy, Constable of Ireland, to whom in 1205 King John transferred the earldom. On the death of Hugh in 1243, the title passed to the husband of his daughter Maud, Walter de Burgh, Lord of Connaught, a kinsman of the famous Hubert de Burgh (see KENT, DUKES AND EARLS OF). William, their great-grandson, whose aunt, Ellen, had been the wife of Robert I of Scotland, was murdered in 1333. His heiress, Elizabeth de Burgh, married Lionel of Ant-

werp, son of Edward III, he thus became Earl of Ulster and Lord of Connaught, and was created Duke of Clarence, William's mother having been a co-heiress of the de Clare family. On the accession in 1461 of their descendant Edward IV these titles merged in the Crown (see MARCH, EARLS OF, for line of descent). The earldom has since been conferred on cadets of the Royal House on Ernest Augustus, Duke of Cambridge (d. 1728), brother to George I, on two Dukes of York, son and brother to George III (see YORK, DUKES OF), and, with the Earldom of Kent, on Alfred, Duke of

Edinburgh and of Saxony (1844-1900), son of Queen Victoria. He, in 1893, succeeded his uncle, Ernest II, as reigning Duke of Saxe-Coburg and Gotha. His English titles expired with him.

ULTRAMARINE, *ul trā mā raen'*. A blue pigment formerly ground from the lapis lazuli (which see). It has brilliance of tone and durability of colour, and is used for oil as well as water-colour painting. The process of extracting the blue pigment from lapis lazuli, which was practised as early as the

vapour lamp is commonly used in medicinal treatment involving exposure to these rays. See **QUARTZ**.

These rays affect photographic plates to such an extent that much of the image in an ordinary negative is due to them. Man, plants, and domestic animals are affected by the rays, for they have remarkable health-giving properties. Persons suffering from tuberculosis and rickets are now being treated by exposure to ultra-violet light. Ordinary glass does not transmit the rays, but quartz, fluorspar, and rock salt are transparent to them. It has been found possible to cure children of rickets, and to prevent the condition, by feeding them with cereals, olive oil, milk, and other foods exposed to the rays. Milk from cows and eggs from hens exposed to the rays also have been found more nourishing. Ultra-violet rays are very abundant in strong sunlight, but are the reverse in cloudy, foggy, or misty weather. Over-exposure causes sunburn and shock, and affects the eyes.

ULUNDI, *BATTLE OF*. See **ZULU LAND**.

ULYSSES, *u lis' eez*. The Latin name of Odysseus, king of Ithaca and the most famous of the Greeks in the Trojan War. He married Penelope, the daughter of Icarus.

When Helen was abducted by Paris, Odysseus was called upon to fulfil his part in the forthcoming expedition to bring her back to her husband, Menelaus, according to a compact which he had entered into.

Throughout the Trojan War, he distinguished himself not only by his great valour, but by the wisdom of his counsel and the keenness of his insight into Trojan methods. He fought with Ajax, and won the armour of Achilles. His wanderings on his return to Ithaca are the subject of Homer's *Odyssey*. Some accounts describe him as cunning and unscrupulous, and state that he attempted to avoid fighting at Troy by pretending to be mad. In this he was detected by Palamedes, whose ruin and death he later contrived. He was succeeded by his son Telemachus.

UMBELLIFERAE, *um bel lif' e re*. Botanical name for the parsley family, from the same root as the word *umbrella*, and applied because most members of the family have flowers arranged in umbrella-like clusters. There are about 2700 species of herbs and shrubs in this family. Representatives of the edible plants in the family are carrots, celery, and parsnips.



ULYSSES AND THE SIRENS

Decoration showing Ulysses bound to the mast of his ship to resist the seductions of the Sirens. A vase in the Vulci Canina Collection.

Photo Maxwell

eleventh century, consisted in grinding the stone, reducing it to a powder by heat, and again grinding it in a mill or with a porphyry slab. The residue of the lapis lazuli was utilized as a neutral tint for skies and draperies. To-day, synthetic means are employed in its manufacture.

ULTRA-VIOLET RAYS. Sometimes called a form of "invisible light," these represent electromagnetic waves that are just too short to be visible to the human eye. Just beyond the violet end of the solar spectrum (the end with the shortest wave-length) is ultra-violet light, with still shorter wave-lengths and faster vibrations. Ultra-violet rays have wave-lengths ranging from about 16-millionths to 59-millionth of an inch. They may be obtained from ordinary sunlight, or from special electric lamps. The quartz mercury

UMBER. A soft, earthy mineral pigment, used in the preparation of oil and water-colour paints. *Raw umber*, obtained by grinding the mineral to a powder, washing it, and then drying it, is the source of a brown paint. *Burnt umber*, prepared from raw umber by heating, has a richer, deeper colour.

UMBRA. See PENUMBRA; SHADOWS

UMBRELLA. A silk or cotton fabric cover attached by folding supports to a handle and used as a protection against rain or sun. A parasol is a type of ornamental umbrella. In the East the umbrella is a symbol of royalty. The steel ribs of the modern umbrella were introduced at the end of the eighteenth century.

UMIAK, u' me ak The Eskimo family boat. See **ESKIMO**.

UNAU, u' naw' See **SLOTH**.

UNCONFORMITY. In geology, the plane of separation between two sets of beds one of which is laid down upon the eroded edges of



UNCONFORMITY
Dolomitic conglomerate on old red sandstone
near Portishead, Bristol

the older series. The two sets of beds usually have different dips. There is an unconformity between the Cretaceous and Eocene strata in Britain. An unconformity usually indicates the lapse of a long period of time between the formation of the earlier and later series, during which the earlier formation has been consolidated, raised above sea level and eroded.

UNCONSCIOUS. The older psychologists who studied the human mind tended to consider consciousness as all-important, and to neglect or deny whatever could not be found by direct introspective observation of their own mental processes. They admitted readily that impressions could be stored in the mind during the times when they were not present to consciousness, but they held that they were inactive, until brought into use in consciousness.

A wider view of the mind came about through the study of abnormal mental conditions. Partly through Freud's work and

partly through that of others, it has become clear that unconscious processes are by no means confined to the production of mental illness. When we lose the electric light bill we may consciously dislike the idea of paying it. But we do not consciously put it in a place where we shall never see it again. This we achieve unconsciously. Dreams show another common way in which unconscious motives find a disguised expression.

A close study of the life of any individual will show that even his most important actions, his choice of a profession, his love relationships, his attitudes towards people and things around him, are determined not only by conscious reasonable considerations, but also by unconscious motives established in very early years, and reinforced throughout the course of his development. These motives remain unconscious because of their powerful and disturbing nature. Full consciousness and free expression of them would prove intolerable. They find expression satisfactorily in indirect ways, in guiding and determining conduct. Where the unconscious forces of the mind are so much in conflict with one another that a normal means of solution through work and social activities becomes impossible, mental illness can develop.

We may think, then, of conscious activity as only a small part of the total mental activity. We are conscious of our present surroundings that interest us and of what has to do with the actual problems engaging our attention. We are much less acutely conscious of present experiences that do not interest us. If we are absorbed in a book, we may scarcely be conscious of the quite audible ticking of the clock. Such experiences are sometimes called subconscious. We are not conscious of a mass of facts and memories that we have acquired, though many of these may become conscious as soon as occasion arises. In Freud's terminology these are called pre-conscious. But guiding all our reactions to present and consciously realized situations is that organized system of instinctive drives, with their related memories and emotions, which remains unconscious which works unconsciously and only makes itself known through the results produced. See **PSYCHOANALYSIS**.

UNCTION, unuk' sh'n, OR EXTREME UNCTION. A sacrament of the Roman Catholic Church administered to an adult who is in danger of death from sickness. It is not administered to those who are in danger of death from some external cause or from some intended enterprise. The sacrament is in accordance with the words of Saint James (James v, 14) "Is any sick among you? let him call for the elders of

the church; and let them pray over him, anointing him with oil in the name of the Lord." The priest dips his thumb in olive oil, previously blessed by the bishop, and makes the sign of the cross upon the eyes, ears, nose, mouth, hands, and feet of the sick one, as he prays, "Through this holy unction, and His most tender mercy, may the Lord pardon thee whatever sins thou hast committed by seeing—" and here mentions the other senses.

UNDERGROUND RAILWAYS. Increase in surface traffic in large cities has, in many cases, made underground means of transport essential. By this means large numbers of passengers can be rapidly transported, and the advantage of underground transport over surface transport is considerable. On the London system the maximum number of trains travelling in one direction over a single track is about forty per hour, with a carrying capacity of 27,000 passengers. The numbers that can be carried by buses and trams are about 7,500 and 12,500 respectively.

Construction. The tunnels are made with the help of a shield, compressed air being used if necessary to keep out water. Tunnels under rivers are sometimes made in sections of steel tubes which are lowered into posi-

tion and fitted together by divers. In making underground stations difficulty is often experienced with mains and cables which have to be diverted.

Signals. In spite of the very great density of traffic underground railways are the safest form of transit. This is due to the very careful and elaborate system of signals and safety devices. The track is divided into sections controlled by signals which are automatically set at danger by the train itself, and kept so until the train is clear of the section.

Should a train overrun a signal it is automatically brought to rest by means of a device known as a trip cock. The signal is set sufficiently far back from the section it controls to allow the train to be stopped in this way before it enters the section.

A device known as the "dead man's handle" stops the train if the driver suddenly becomes incapacitated. In case of fire the current can be cut off by pinching together two wires which can be reached from the driver's cab.

There is also another device which prevents the train from starting unless the pressure in the braking system is sufficient.

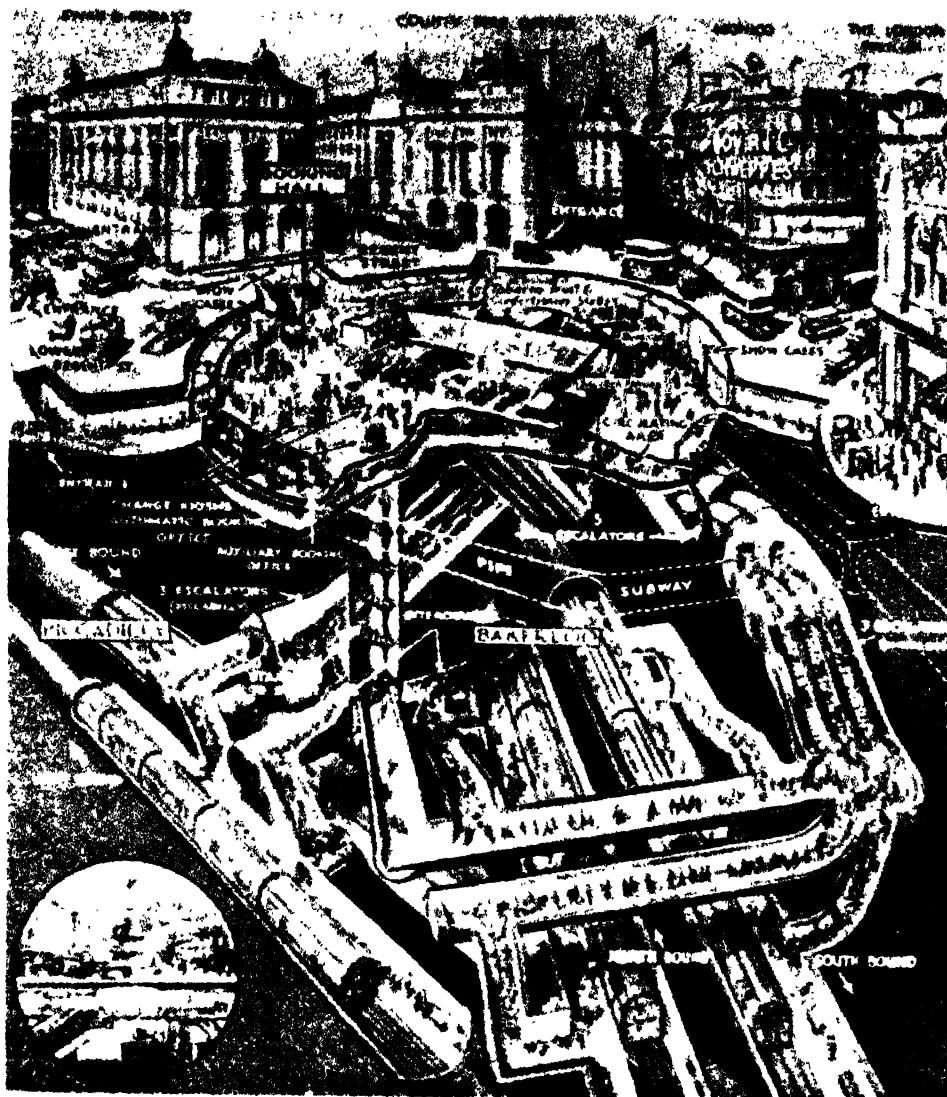
Train Service. In London, trains start



LONDON UNDERGROUND RAILWAYS

1. Tunnel on the Piccadilly line.
2. Electric colour light signals on the Underground Railway at a point outside the tunnel.
3. Vent fan, having an axial flow of 100,000 cubic feet per minute, at Holborn.
4. Escalators at Leicester Square Station.

Photos: London Passenger Transport Board



SUBWAYS AT PICCADILLY

This revealing diagram shows the huge station on the London underground railway

Photo Keystone

running at about 5 a.m. There is heavy workmen's traffic until 7.30 a.m. when workman's tickets are no longer available. The city rush then starts from 8.20 to about 10.30, and the homeward rush, which is the heaviest in the day, from 4.50 to 6.45. From 7.30 to 8.30 is the theatre rush, followed by a slack period from 8.30 to 10.45, after which traffic is heavy until the lines close about 1 a.m. This varying demand is met by altering the frequency of the trains and

also the number of cars on each. The allotment of staff must also be carefully considered, and to arrange that each man works as near as possible an eight-hour day with as little overtime as possible and with intervals for meals calls for a considerable amount of ingenuity on the part of the time-table department.

UNDERWRITING. Underwriting is concerned with the issue of shares by a company. Where a company creates a new issue

of shares, in order to finance some project, it often wants to be sure that the whole of the issue will be subscribed for; since it may be that a fraction of the required capital would be useless to the company. The company therefore enters into a contract with a firm of underwriters, who, in return for a commission, promise to take up and pay for any share which is not subscribed for by the general public. See also **INSURANCE** (*Marine Insurance*).

UNEMPLOYED ASSISTANCE BOARD. See POOR LAWS.

UNEMPLOYMENT. When a person, willing and capable of being usefully employed in industry, cannot be gainfully absorbed into the industrial organization, that person is said to be in a state of unemployment. The expression cannot be applied to the sick, infirm, or to that section of the community that lives on unearned income.

The superficial reason for unemployment is that it is due to the supply of labour being greater than the demand, but it may be due to varying causes, such as a deflationary monetary policy, or the introduction of new processes of production that displace labour temporarily.

Unemployment has three main classifications, i.e. normal, seasonal, and cyclical. The amount of normal unemployment is difficult to calculate. Ever since the rise of the industrial system, unemployment has existed in varying quantities. Sir W. H. Beveridge, who has studied the problem to an extent probably greater than any other investigator, declares that there is an "irreducible amount of unemployment" which constitutes a "reserve of labour." Even this normal unemployment, however, seems to fluctuate considerably. In the last century, for instance, so far as can be calculated from the trade union and other returns available, unemployment in a boom period could fall so low as 1 per cent, as it did in 1870; but in 1929, when the economic situation of the world was, comparatively speaking, most prosperous, there were more workers unemployed or on short time than there were normally during the slumps before the war. In spite of the boom conditions then prevailing, the percentage of trade union members unemployed or on short time in June-July, 1929, was (according to International Labour Office figures):—

	Completely Unemployed	On Short Time
Germany	8.5	6.8
Great Britain	7	2.6
Sweden	7.2	—
Norway	11.3	—
Denmark	10.0	—
Australia	11.0	—
New Zealand	9.3	—

"Seasonal" unemployment is easier to understand and to measure. Obvious examples are those of seaside catering trade workers, who are employed up to about maximum in the summer months and are almost wholly unemployed in the winter months, and have to seek employment in other spheres; building operatives and stone quarry workers have the same experience, printers are "slack" in the summer and are busy in the winter; woollen textile operatives, miners, and many other categories of workers all have periods when demand is much greater than it is at other periods.

Causes of cyclical fluctuations are more difficult to fathom and are still a subject for discussion and investigation. Many factors were at work to bring about the depression of 1931-32, when unemployment reached its peak, the total number of unemployed workers in the world then being estimated as at between 25,000,000 and 30,000,000. World deflationary policy, problems connected with reparations and war debts, exchange restrictions, increasing tariffs were, so many consider, mainly responsible, but severe depressions have existed before, and in 1845, the period of "the hungry forties," more than 33 per cent of the workers were believed to have been unemployed. There is, however, an increasing number of responsible thinkers holding the view that "booms" and "slumps" can be "ironed out," and that with adequate measures cyclical depressions, with their swollen figures of unemployment, need not recur on the same formidable scale.

The responsibility of alleviating distress caused by unemployment has always been recognized by the State, not merely in the provision of Poor Law relief for the destitute, but also for the provision of public works, so that a percentage of the workless may be able to earn sufficient to maintain them. So long ago as 1886, the then President of the Local Government Board (the department which at that time was responsible for the supervision of the activities of the local authorities) was urging local authorities to provide work in times of distress. In 1909, employment exchanges were created in Great Britain to assist unemployed to find work.

Most States came to recognize that compulsory insurance against unemployment was vitally necessary, and in 1911 the principle was introduced in Great Britain, and later was extended.

The system of special expenditure on public works for the relief of unemployment, however, has not recently found favour with the British Government. See **DOLLS**.

UNEMPLOYMENT INSURANCE. This is a compulsory insurance in Great Britain, to

which the State, the employers, and the employees are contributors. Its object is to provide benefit in the event of unemployment. The contributions are payable in the first instance by the employer, who is called upon to affix stamps of the correct value to the insurance cards of his employees. The employer is authorized to deduct from the wages of the employees the amounts representing their share of the contributions. Unemployment insurance is administered by the Ministry of Labour through the Employment Exchanges.

UNFUNDED DEBT. See NATIONAL DEBT.

UNGULATES, *ung' gū lays*. From the Latin *ungula*, meaning "hoof, claw," this is the name applied to animals which have the last joint of the toes encased in a hoof, or a hoof-like nail. As a rule, ungulates are useful to man. Zebras, elephants, the hippopotamus, and deer are all wild ungulates, and horses, sheep, goats, cattle, and pigs are domestic animals of the order. They are further divided into *odd-toed* ungulates, such as the horse, which is one-toed, and the rhinoceros, which has three, and the *even-toed*, such as the pig, with four toes. Ungulates are the only horned mammals, but not all ungulates possess horns; frequently, it is only the male which has them.

UNICORN, ū' nī korn. In the writings of the ancient Greeks and Romans, the unicorn was an animal with head and body like

the hind legs of an antelope and the tail of a lion. No horse could overtake it. The word appears in the Bible, but it is considered there a mistake in translation for "wild ox," which has been substituted in the Revised Version. It is known to-day only with reference to heraldic designs. See HERALDRY.

UNIFORMITY, ACTS OF. Parliamentary enactments of various dates, beginning with the Act of 1548 in the reign of Edward VI, prescribing the forms of public worship in England. The first Act of Uniformity enforced the use of the Common Prayer Book under penalties which for a third offence extended to imprisonment for life. The most important of the Acts was that of 1662, passed two years after the restoration of the monarchy. This required the revised edition of the earlier Prayer Book to be used in all churches, and visited with heavy punishment those who attempted to conduct public worship in unauthorized places. By enforcing Episcopal ordination, the Act had the effect of depriving some 2000 Presbyterians and other incumbents, who had been inducted into vacant benefices during the Commonwealth, of their legal status; these could not conscientiously subscribe to and use all that the Prayer Book contained. From time to time modifications in the prescribed forms have been made by Parliament to meet special circumstances, as for example, in 1871 when the lectionary was altered.

The Acts of Uniformity apply to-day only to the forms of worship used in the Church of England. To follow these forms is a statutory duty in the Established Church, but not elsewhere.

UNIFORMS AND INSIGNIA. Prior to the seventeenth century, uniforms were seldom employed, the distinguishing factor in warfare being generally the standards of the various leaders. Uniforms were, however, sometimes introduced by individual wealthy commanders who provided the men under them with coats of a single colour. When in 1645 Parliament raised an army the men were clad in the civilian costume of the day, but in the single distinctive colour, red. To denote individual regiments, facings of other colours were employed. The development of modern uniforms may be traced back to this point. In many instances useless decorations in the form of braid and buttons are direct survivals of counterparts that originally had practical functions. With the general adoption of uniforms the need for insignia became pressing. (Insignia do not, of course, owe their origin to this, for the golden spurs of the medieval knight and the purple of the Roman emperors are familiar earlier examples.) Decorations awarded for special merit or bravery were added to the



UNICORN HERALDIC EMBLEM FOR KING GEORGE V
MEMORIAL PLAYING FIELDS

Photo: Fox

those of a horse, in size and form, and which had on its forehead a single, straight horn, white at its base, black in the middle, and red at the tip. The body of the animal was white, its head red, and its eyes blue. It had

insignia of rank in the fighting forces, because the outward mark of achievement is a spur and encouragement to emulation.

UNION OR TOKELAU ISLANDS. They lie in the western Pacific between lat 8° and 10° S and long 171° and 173° W. There are four groups of low coral atolls with a total land area of 7 square miles. Coconut palms are the only crop of importance. The population consists of a few hundred Polynesians. The islands became a British Protectorate in 1889 and formed part of the Gilbert and Ellice Colony from 1916 to 1926, when they were transferred to New Zealand and put under the administration of Samoa.

UNIONIST PARTY. See CONSERVATISM

UNION JACK. See FLAG.

UNION OF SOUTH AFRICA. A self-governing Dominion within the British Empire, and occupying the extreme southern part of the continent of Africa. It consists of four provinces, namely, Cape of Good Hope, Natal, the Orange Free State, and the Transvaal. By a mandate from the League of Nations, 1920, South-west Africa, formerly a German colony, was made a mandated territory of the Union.

The Union has an area of 471,917 square miles. It lies almost wholly south of the Tropic of Capricorn, and extends southward to 35° south latitude.

Of the four provinces, Cape of Good Hope, or Cape Province, is the largest, with an area of 256,536 square miles, the Transvaal is second, with 110,450, the Orange Free State

has 49,647; and Natal, 35,284. The populations of the provinces are approximately as follows. Cape of Good Hope, 3,529,027; the Transvaal, 3,341,144; Orange Free State, 771,825; Natal, 1,946,640. In the census of 1936 the European population of the Union was 2,003,512, an increase of 9.6 per cent in five years.

Physical Features. The country may be roughly divided into an interior plateau, more than 4000 feet above sea level, and the coastal region, which is the only area below an elevation of 1500 feet. The interior plateau, which occupies about fifty per cent of the area, consists in large part of vast, undulating plains and steep hills, barren or sparsely covered with brushwood in the drier parts. The eastern part of the country is covered with grasslands called *veld*, which afford pasturage for sheep. On the rim of the interior plateau are some of the highest points in South Africa, several peaks rising higher than 10,000 feet in the so-called Drakensberg Range. On the boundary of the plateau there is the Great Escarpment, which parallels the coast for about 1400 miles. The Witwatersrand in the Transvaal (usually called "The Rand") forms the watershed between the rivers flowing to the Atlantic and Indian Oceans.

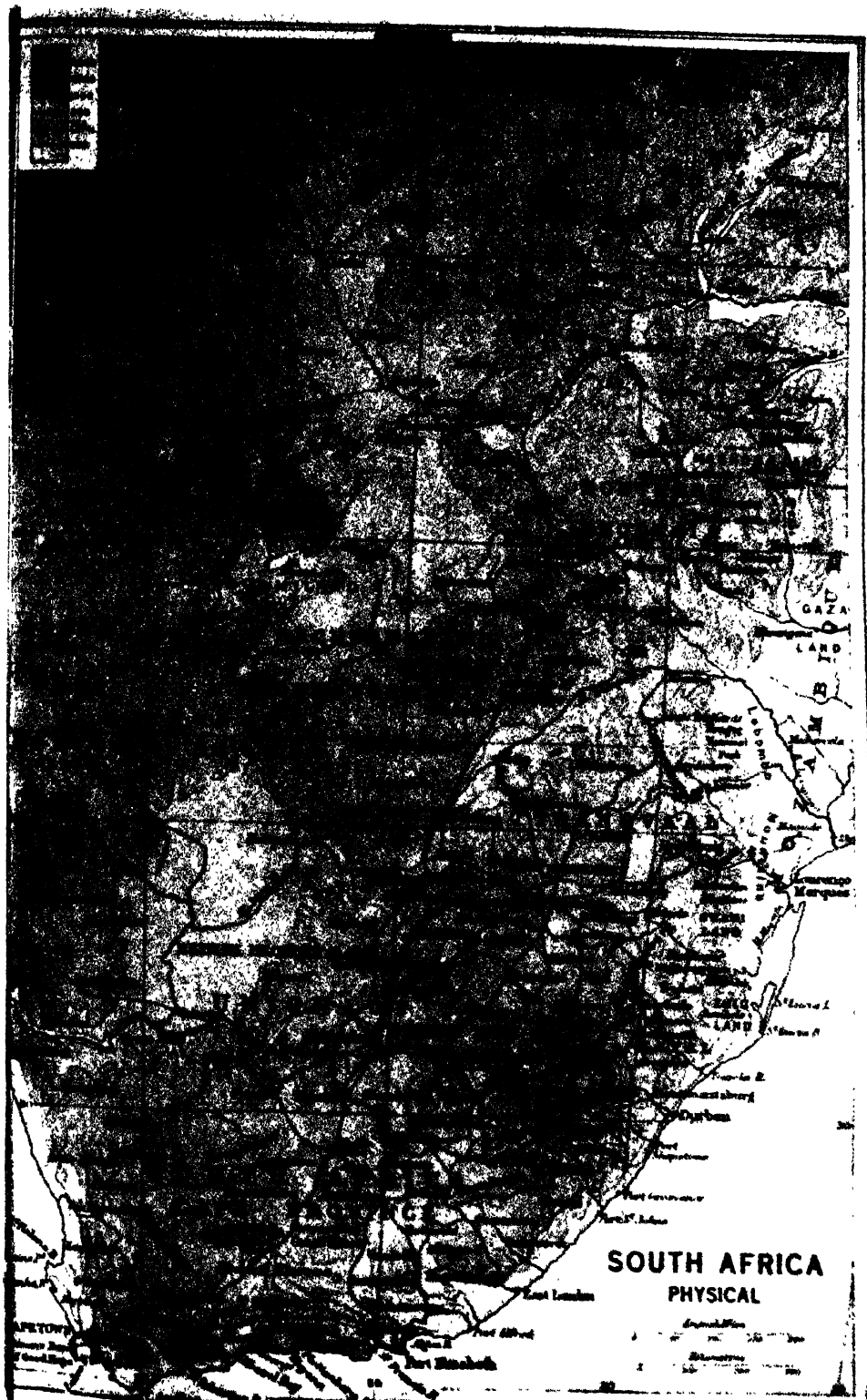
Beyond is the coastal region, which includes the Great Karroo, and the "fold" mountains of the south, low hills of shales and sandstones, having little rainfall and hence little vegetation. Along the eastern coast,



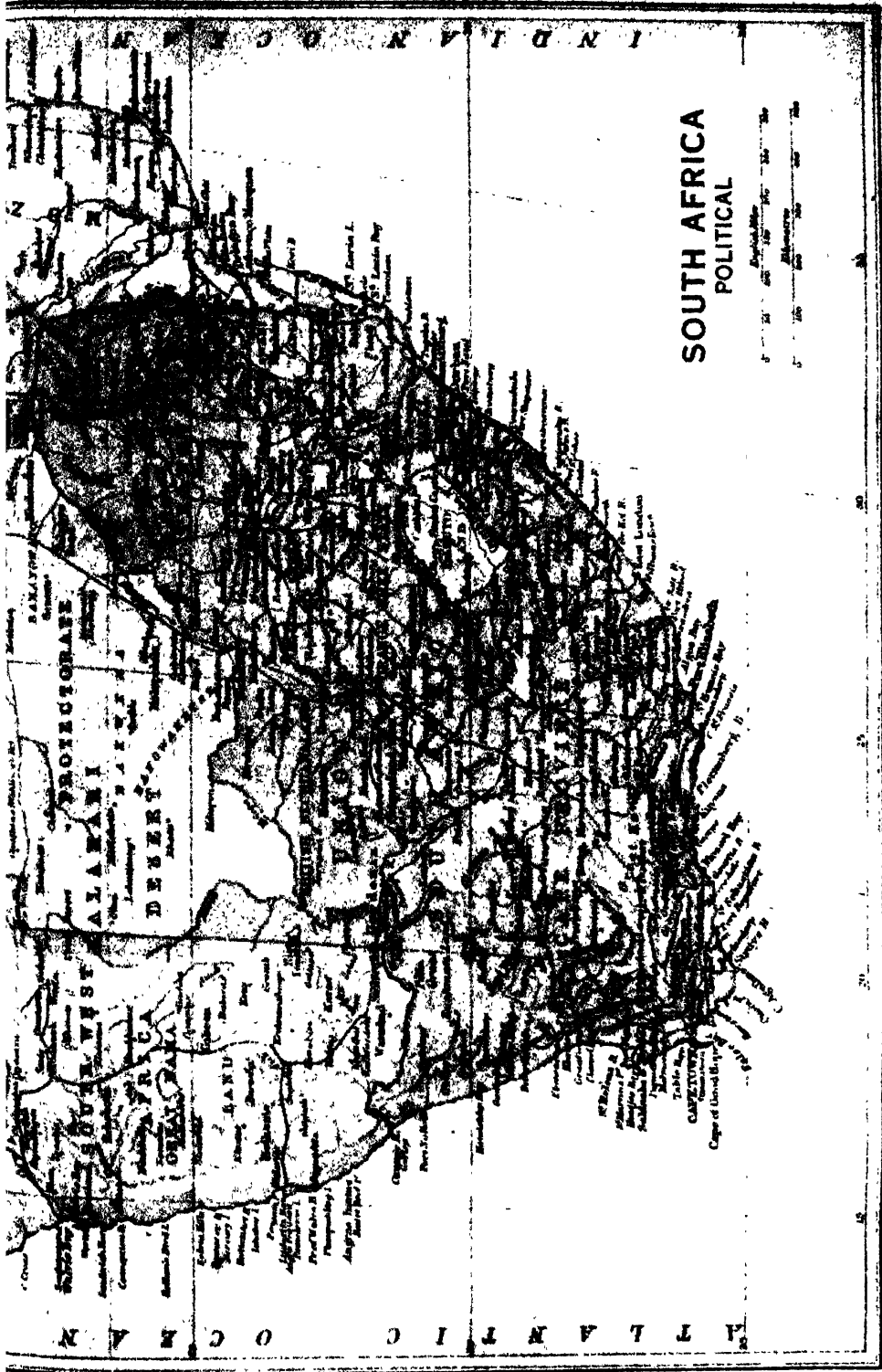
A VIEW OF PRETORIA FROM MEINTJES KOP

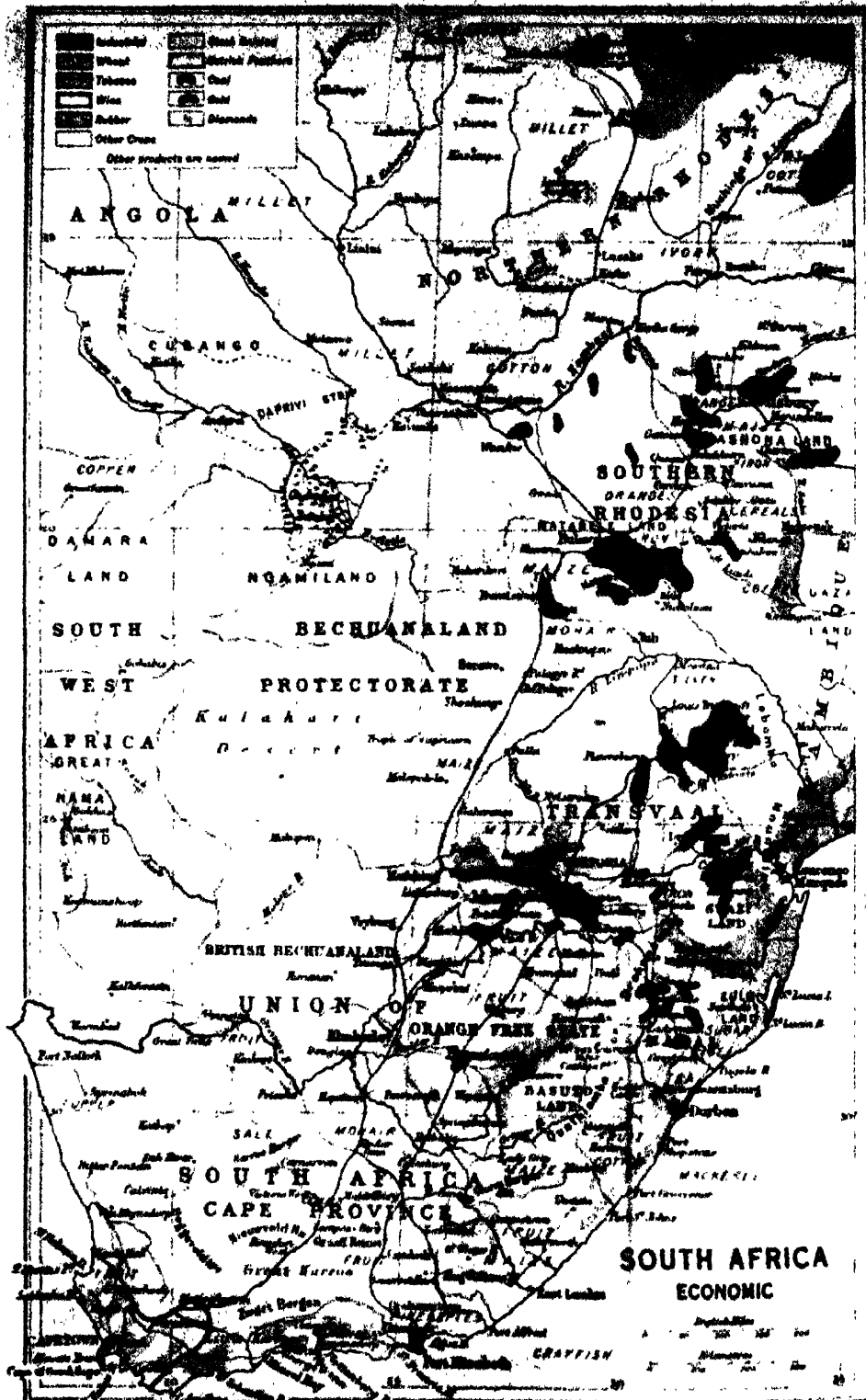
In the foreground is the back of Union Building in which are the offices of the Governor-General, the Prime Minister, and the Cabinet.

Photo U. & U.











WYLLIE'S POORT, A BEAUTY SPOT NEAR PIETERSBURG, NORTHERN TRANSVAAL

Photo. U. & U.

however, rainfall is adequate, and part of Natal has an annual precipitation of thirty-five to fifty inches. Cape of Good Hope Province is the driest, with five to fifteen inches yearly. The climate is healthy for white settlers.

Agriculture. Lack of rainfall over large areas is a serious hindrance to agriculture, and irrigation is not always possible, because the rivers often flow in deep valleys below the surface of the surrounding country. The farm products vary with the climate, though maize is the staple grain crop. The Mediterranean climate of the south-western part of Cape of Good Hope is suited to citrus fruit, grapes, peaches, apricots, and wheat. Natal, Zululand, and the Northern Transvaal have greater rainfall and a humid, sub-tropical climate, conducive to the production of pineapples, oranges, bananas, etc. In the south-west corner the vine does well. Sugar and tea plantations are found in the coastal regions of Natal, and tobacco is important in the Transvaal.

Sheep farming is the most important division of the livestock industry, and the mohair and wool produced are valuable exports. Cattle farming, for both beef and dairy purposes, is to-day receiving intensive attention whilst ostrich farming is less extensive.

Mineral Deposits. The mineral resources are varied and extensive. South Africa is the largest producer of gold in the world and produces the finest diamonds.

The Union is also rich in other metals and minerals, such as silver, asbestos, corundum, platinum, tin, copper, lead, antimony, mica, chrome, fluorspar, magnesite and many others. Coal, too, is plentiful.

Manufactures and Commerce. The industries, most of which are on a small scale, include the manufacture of metals, foodstuffs and beverages, chemicals, clothing, textiles, wagons and other vehicles, and furniture.

More than 65 per cent of the exports are minerals and nearly 30 per cent agricultural or pastoral products; among the latter, ostrich feathers, hides and skins, wool, mohair, fruit, maize, wine, and dairy products are important. Great Britain, India, France, Germany, and the United States are the largest buyers. Of the imports, which come principally from Great Britain, United States, and Germany, textiles and clothing are the most important, followed by food products, hardware, electrical machinery, drugs and chemicals, and motor cars.

The People and the Government. The population of the Union was 9,588,665 in 1936, less than a fourth being white and of



CLARIUS KLOOF

It is near Bethlehem, Orange Free State.

Photo: South African Railways

British or Dutch stock. The native peoples include the Bantus, Hottentots, and Bushmen, with a small proportion of mixed stock having white blood. The government is conducted by a Premier and Executive Council and a Parliament of two chambers. The Governor-General is appointed by the Crown on the advice of the South African Cabinet. He is the personal representative of the King. The legislative function is discharged by a Senate of forty members (eight nominated and thirty-two elected) and an elective House of Assembly having 150 members. Its members must be South African nationals of European descent. South Africa is an entirely autonomous state, with its own diplomatic representatives in several states.

At the head of the government of each province is an administrator, appointed by the Governor-General for a term of five years. There is an elective provincial council, whose members are chosen for five years. All legislative acts of the councils are subject to the veto of the Governor-General in Council, that is, the Union Cabinet. The English and Afrikaans languages are both official. Pretoria is the seat of government of the Union, but the Parliament meets at Cape Town, and the Appellate Court at Bloemfontein.

Education is free in the primary grades, and for white children between the ages of seven and fifteen (in the Cape Province from

seven to sixteen), it is compulsory. The provincial governments have complete control of all education under university grade except vocational or technical schools. There are five universities: the University of South Africa, the University of Cape Town, the University of Witwatersrand, the University of Stellenbosch, and the University of Pretoria.

Communications. Prior to the formation of the Union, the state railways were operated by the four governments. In 1910 they were merged into one system, called the South African Railways, and placed under control of the Union government. The total mileage exceeds 13,000. The railways connect with the lines of Rhodesia and the Congo. There is a twice weekly air service with London.

The Towns. In two cities of the Union, Johannesburg and Cape Town, the European population is 252,579 and 151,621, being fully half the respective populations. Durban is third, with 230,547 people, 88,095 being white. Pretoria has grown to about 108,330 (68,441 white). Port Elizabeth is 98,604 (48,600 white). There are eight smaller towns ranging in population from 35,000 to 68,000.

The capitals of the provinces, the seats of the provincial councils, or legislatures, are as follows: Cape Province, Cape Town; Natal, Pietermaritzburg (population 30,000); the Transvaal, Pretoria; Orange Free State, Bloemfontein (population 30,000).



RIVER JORDAN AT BETHLEHEM, ORANGE FREE STATE

Photo: South African Railways



NATIVE LIFE IN THE UNION OF SOUTH AFRICA

1. Rickshaw boy of Durban with ornamental beaddress. 2. Head of a Hottentot. 3. A Zulu warrior
4. Zulu kraal. 5. Native children. 6. Interior of a native hut. 7. Headdress of a Zulu belle

South African Railways



GRAAFF REINET (VALLEY OF DESOLATION)
It is in Cape Province.

Photo: South African Railways

History. First Holland and later Great Britain were responsible for most of the early colonization in Africa. In 1806 the British took the Cape of Good Hope Colony from the Dutch, and in 1843 Natal was annexed to the Cape Colony, though it was made a separate government thirteen years later. The Orange River Colony and the Transvaal remained independent republics. In 1867 diamonds were discovered in the Orange Free State and the adjacent areas, and in 1884 gold in the Transvaal, and there was a great influx of settlers.

Differences of outlook and interest between the new settlers and the original people led to the South African War (1899-1902). As a result of this war Britain annexed the two republics. In 1906, however, representative government was restored though the new States were now under the British, and in composition they differed considerably from the former republics.

In 1910, as a result of discussions which took place in 1908 and 1909, the four separate States united to form the Union of South Africa. Since the formation of the Union there has been a notable growth of the feeling of nationality. The people of South Africa have realized that not only are they people of the Cape or the Orange Free State, they are also people of a great nation, the Union of South Africa.

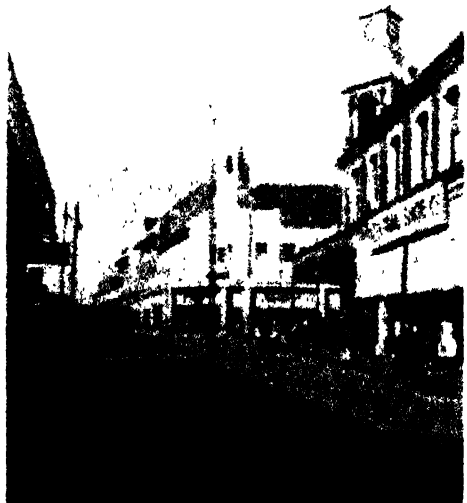
It was the World War which demonstrated to the world that South Africa was

henceforward to be reckoned with as one of the smaller Powers. In the campaign against the Germans in South-West Africa, her troops played a leading part, and she also sent a contingent overseas to Europe. There were those who thought that the greatness of South Africa could best be assured by secession from the Empire, and they took up arms to enforce their views. They were not successful, for the majority felt that however men's views differed on political questions and whatever be their traditions, South Africa should present to the World a united front. The years since the war have seen a remarkable development in the wealth of South Africa, and a corresponding development in her political life. She has many difficulties to contend with, for the traditions of her people differ so radically, but she is facing them with courage.

The years since the war have seen several changes of ministries.

In 1919 General Botha died and General Smuts assumed the Premiership. Later years brought a growth in the power of the Nationalists, and in 1924 the latter united with the Labour Party and Hertzog, the Nationalist leader, became Prime Minister.

Once in office he displayed qualities of statesmanship which not all had realized he possessed. By his direction of public affairs, he showed that he considered that certain measures, though they might be desired by a majority at the time, might prove so obnoxious to others, that they would do irreparable harm. By his policy of hastening



JONES STREET, KIMBERLEY

Photo: South African Railways



RAAD ZAAL (THE OLD COUNCIL HOUSE), BLOEMFONTEIN

This building is now the House of Provincial Assembly in the capital of the Orange Free State.

Photo U. & U.

slowly he lost the support of many of the more extreme members of his party. In 1932, together with his supporters in the Nationalist Party, he united with Smuts to form a National Government. This union lost him the support of many other Nationalists, and subsequent events showed that about 60 per cent of the members of the Nationalist Party went into opposition.

South Africa is a member of The League of Nations. See also Dominions Volume.

UNION OF SOVIET SOCIALIST REPUBLICS. See RUSSIA.

UNITARIANS. This is the name of a religious body whose members deny the Christian dogma of the Trinity. While holding that Jesus Christ was the greatest of religious teachers, they do not attribute to him more than an exalted humanity, and reject his miraculous birth and the claims made by orthodox Christians of his divinity. They hold that God is One with no Trinity of Persons. They also reject the doctrines of original sin and eternal punishment, but they adhere to the teaching of Christ concerning the Fatherhood of God, the brotherhood of man, and everlasting life.

The first Unitarians in the above sense were the followers of Socinius in the sixteenth century in Poland, who, however, while denying the divinity of Jesus, differed from the later Unitarians in allowing his miraculous birth. A large number of Socinians still exist in Transylvania.

In England in the same century and onwards to the time of the Commonwealth

sporadic groups of Unitarians arose and suffered from persecution. It was not till 1775 that the Unitarian body was organized under the influence of Theophilus Lindsey, who had seceded from the Church of England. Ten years later, in America, King's Chapel in Boston accepted Unitarianism, and expunged from its Prayer Book all mention of the Trinity and the divinity of Christ.

Unitarianism has flourished considerably both in America and England.

UNITARY STATE. A body of people whose unity is based on nationalism and whose independence is maintained under its own government, e.g. France, Denmark, Belgium, etc. When a number of hitherto unitary States, while preserving their independence in the administration of their home affairs, unite for certain well-defined purposes, the union becomes a *federal* State, with a written federal constitution, e.g. the United States of America.

UNITED KINGDOM. A phrase used for the legal term UNITED KINGDOM OF GREAT BRITAIN AND IRELAND. It refers to the political union of England, Ireland, Scotland and Wales, and was formally adopted on 1st January, 1801, although it had been used by James I in 1604. Since the granting of Dominion status to the Irish Free State, the United Kingdom has ceased to comprehend this part of Ireland but still includes Northern Ireland, the Channel Islands, and the Isle of Man.

UNITED PROVINCES. The name given in 1902 to the united Indian provinces of

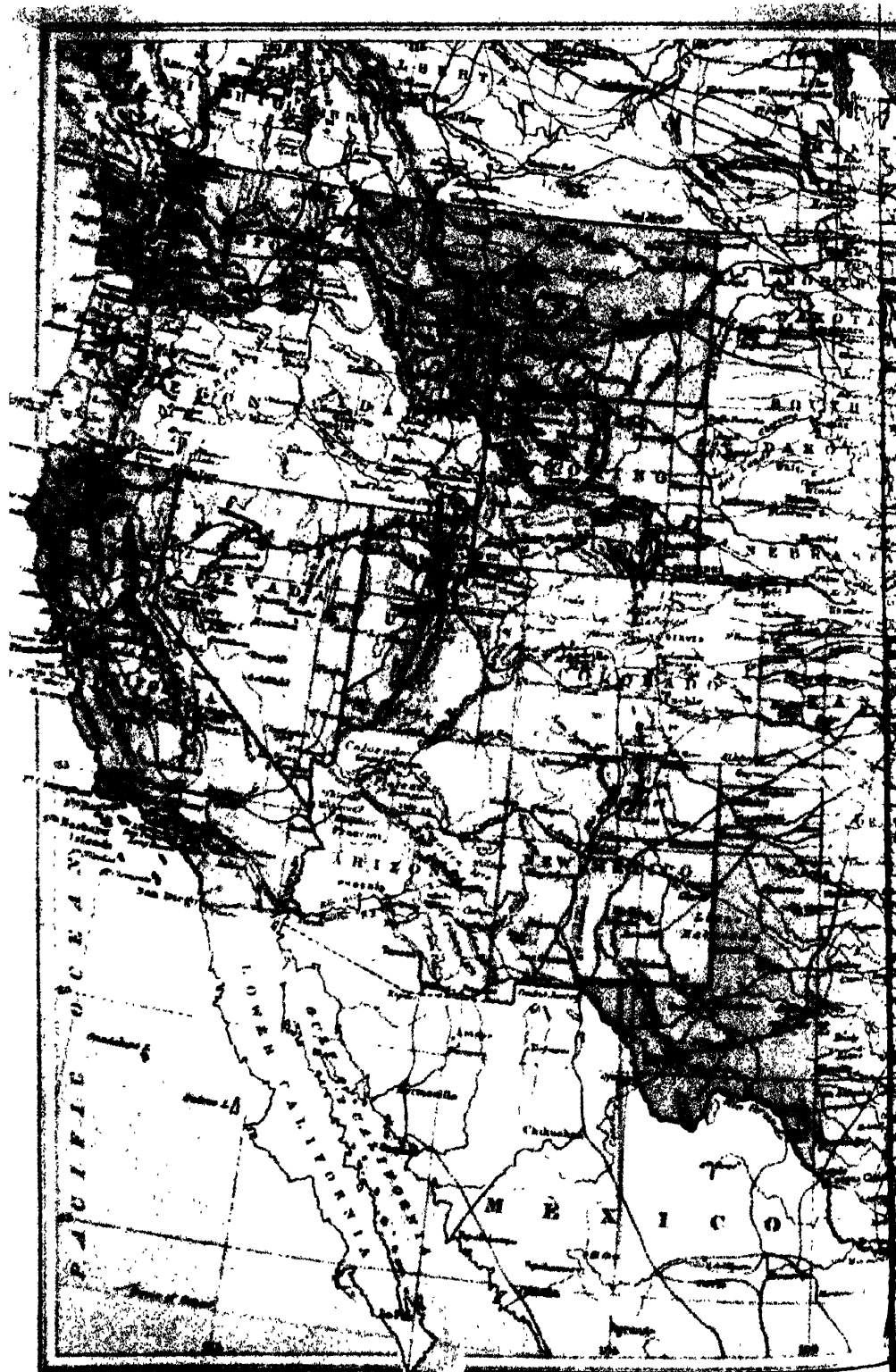


SCENES IN THE UNITED PROVINCES

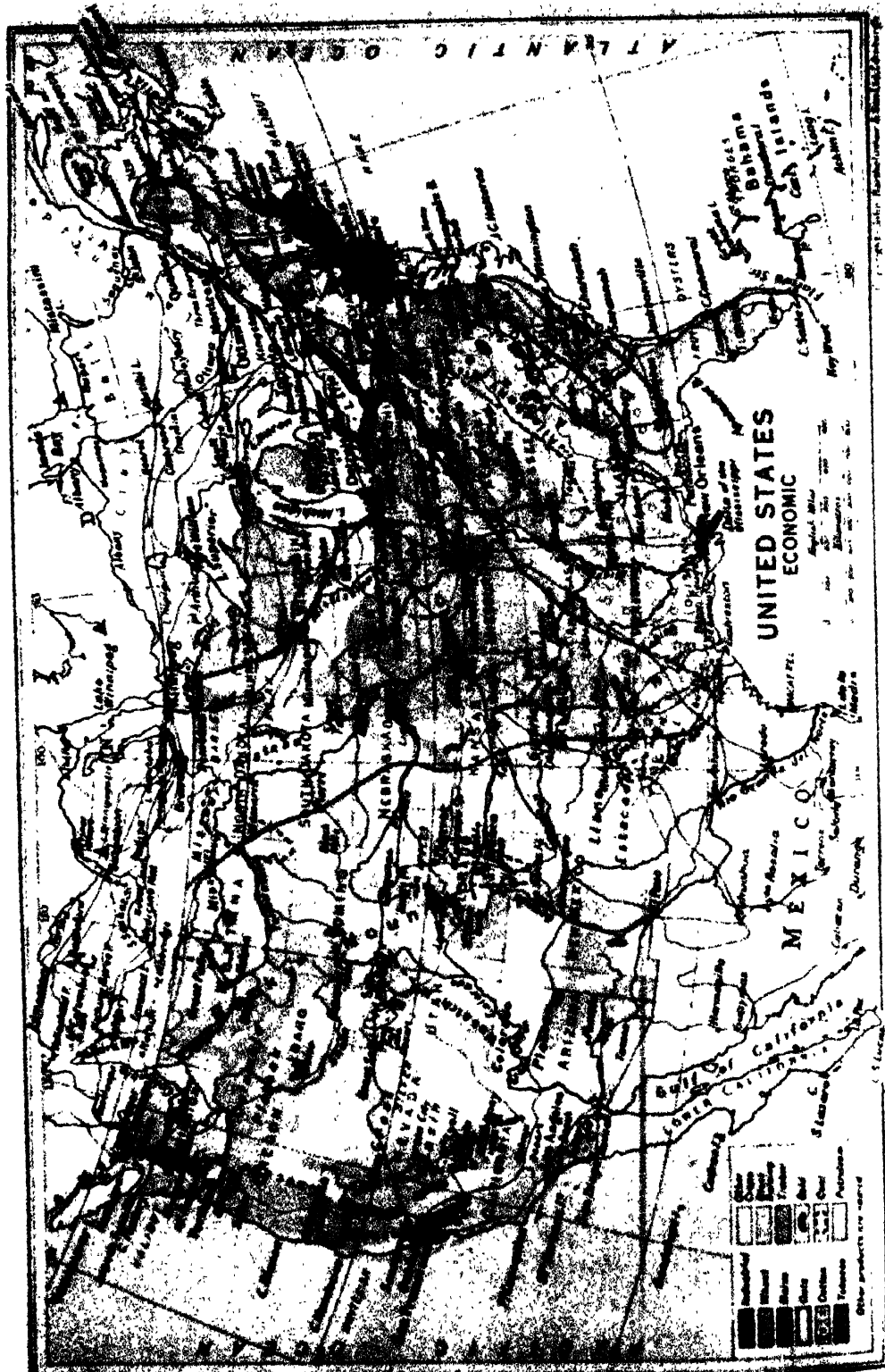
The Bathing Ghats at Benares. 2. Bathing Ghats at Hardwar. 3. Temple at Muttra 4. Street scene in Benares

Photos. Indian State Railways









Agra and Oudh. The native States of Rampur, Tehri-Garhwal and Benares are included in the area which comprises the upper part of the Ganges basin and totals 112,191 sq. miles. The area of British territory is 106,246 sq. miles. In 1931 the total population was 49,614,833, and that of British territory 48,408,763. Hindus vastly predominate. In the main the country is flat, well watered, and intensively cultivated. There are two harvests, in spring and autumn. Wheat is the staple product, and millet, rice, barley, and pulse are also grown extensively. The Ganges, Jumna and Gogra rivers rise in the Himalaya Mountains and meet within the province. Considerable irrigation work has been undertaken, the greatest being the Upper Ganges Canal. The climate is generally dry, and hot, the temperature reaching 115° F. in the shade during the hot season around Allahabad and Benares. Oudh was not annexed until 1856, and both Oudh and Agra were for a time under the control of the nabobers during the Indian Mutiny. The chief cities and centres of trade in the United Provinces are Allahabad, Cawnpore, Agra, Meerapur, Benares, Morad, and Moradabad.

UNITED STATES OF AMERICA. The continental area of the United States, exclusive of Alaska, including inland water area, comprises 3,796,911 square miles, with all outlying possessions, the grand total is 3,738,395 square miles.

In 1867 the United States bought Alaska from Russia, and since 1898, the United States

has also acquired by annexation or by purchase other outlying possessions, including the Hawaiian archipelago, Samoa, Guam, the Philippine Islands, Puerto Rico, the Virgin Islands (formerly Danish West Indies), and the Panama Canal Zone. These, with the forty-eight states of the union, constitute the United States.

Physical Features. The United States exhibits most of the physical features found in North America as a whole.

The coastal plain is mostly submerged in New England, but it increases in width toward the south, becoming broadest along the Gulf of Mexico, where, for miles northward, the land is only a few feet above the sea. Along the inner edge of the coastal plain where the rivers pass from older rocks to the softer ones of the plain, is a regular "fall line", that is, a series of falls or rapids in the rivers.

The Appalachian highland consists of four belts, roughly parallel to each other, extending from New England to Alabama. Just above the fall line is a hilly district called the Piedmont (*foot of the mountain*), which is much older than the coastal plain. In general west of the Piedmont rise mountain ranges cut through by a number of rivers. These gaps furnish routes for highways and railways.

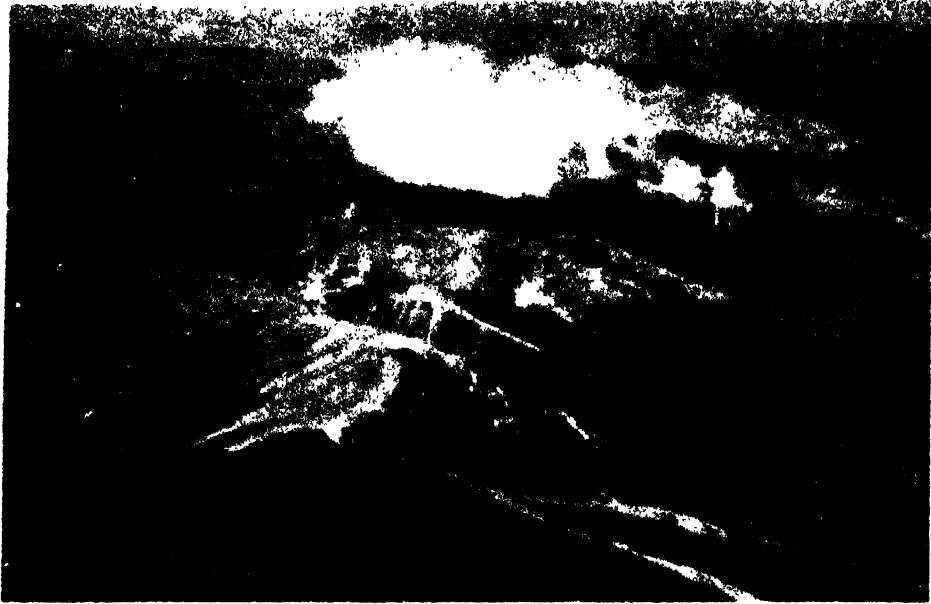
West of these ranges lies the Great Valley, extending from Canada to Alabama, averaging perhaps forty to sixty miles in width.

West of the Great Valley rises the abrupt edge of the great plateau which slopes down



RIDGES OF THE SMOKY MOUNTAINS, TENNESSEE

Photo U. & C.



SUMMIT OF MOUNT WASHINGTON
This peak is the highest in New Hampshire
Photo Keystone

gradually westward toward the Mississippi Valley. This plateau, called the Catskills in New York, the Allegheny in Pennsylvania, and the Cumberland Mountains in the South, has been deeply cut into by numerous rivers, giving much of it a very rugged surface. A large portion of it is also covered with thin, sandy soil.

The interior plain extends from the Allegheny-Cumberland plateau to the Rocky Mountains, and from the Gulf of Mexico to the plains of Canada and the Arctic Ocean. There are several smaller highland areas. These include (1) the uplands on both shores of Lake Superior, which are a continuation of the Laurentian highlands of Canada; (2) the Ozark plateau in Missouri and Arkansas, and (3) the Black Hills, an outlying portion of the Rocky Mountains.

Near the Rocky Mountains, the plain gradually rises, becomes more rolling, and is cut by deeper valleys. The region between the Ohio River and the Rockies is that known as the Middle West.

The Western Cordilleras include the entire region from the Rocky Mountains to the Pacific Ocean. The Rocky Mountains, forming the continental water parting between the Atlantic and the Pacific oceans, present a practically continuous front toward the east.

Between the Rocky Mountains and the Sierra Nevada-Cascade range lies a lofty

plateau traversed by numerous lesser ranges. This plateau is drained in part by the Columbia and the Colorado rivers, but in part it forms the Great Basin in Utah and Nevada, which has no outlet to the sea. Finally, the Sierra Nevada-Cascade range, bounding this plateau on the west, is cut through by several rivers, notably the Columbia. Taken as a whole, the Cordilleran highland is broken by no waterway, and its lowest pass is about a mile above sea level. It thus obstructs commerce far more than do the Appalachians.

The Pacific Slope includes the fertile Pacific valleys in California, the Willamette in Oregon, and Puget Sound, and beyond, the low Coast ranges, which descend abruptly to the Pacific.

Climate. Owing to the north-and-south direction of the mountain ranges, North America is a climatic as well as a topographic unit, showing no abrupt change at any point between the Gulf of Mexico and the Arctic Ocean. On the other hand, the climatic changes are more abrupt from east to west. The Atlantic slope, especially in New England, has a variable climate. The great interior plain is subject to extremes of heat and cold, while the Pacific coast, where western winds prevail, has a mild, oceanic climate. The extreme southern states have almost tropical temperatures.

The rainfall likewise varies from east to

west, being heavy on the Atlantic and Gulf coasts, lighter in the interior, and heavier again on the Pacific slope. From about the 100th meridian westward to the Sierra Nevada range, the rainfall is usually insufficient for the type of agriculture found in the eastern part of the country. The north-and-south trend of the mountains checks the moisture-laden west winds, and renders nearly half of the continent arid or semi-arid in character.

In the United States, as in other temperate regions, the distribution of moisture is influenced by the passage of cyclonic storms (see (CYCLONE). Areas of low pressure are constantly travelling across the continent from west to east, and causing rain. In the interior of the country, east of the Rocky Mountains, the heaviest rainfall is in the summer, during the growing season, while west of the Rocky Mountains the prevailing rainfall is, as a rule, in winter.

People. Previous to the Revolutionary War, most of the settlers, apart from the negro slaves, were of British origin, though Pennsylvania was nearly half German. After the Revolution, immigration remained light until about 1840, but thereafter it increased in volume from year to year. From 1840 to 1860 most immigrants came from Northern and Western Europe, after about 1860, with the opening up of other new countries, notably Australia, Canada, Argentina, and South Africa, the number coming from Northern Europe greatly decreased, and a flood of immigration set in from Southern

and Eastern Europe. Immigration reached an average of 1,033,000 in 1911-1914, then sharply decreased during the World War. It again increased to 550,000 in 1920-1924, but was curtailed by the Johnson Bill, introducing quotas for each country in 1924. Total population (1930 census), 137,008,435.

The early immigrants largely came in search of free land and became farmers, but the newer, for the most part, have found employment in cities, so there have grown up in each of the large cities districts inhabited almost exclusively by immigrants of one nationality and language. In spite of this fact, the second generation in most cases appears to be interested in the United States rather than in Europe.

Natural Resources. The fur trade was the first of any importance in the United States, but since the development of the country many of the valuable fur-bearing animals have so decreased in numbers, that the trade is no longer of great importance. Fur farms, however, are now taking the place of trapping, and the trade is again increasing.

The fishing, both sea and inland, is of considerable importance, especially off the New England coast where there are extensive fishing banks, where are caught cod, herring, etc. On the Pacific coast in the less developed areas such as Oregon and Alaska, the salmon fishing is of great importance, the fish being canned both for home consumption and export. Fish are caught also in the Great Lakes and off the Florida coast, where there is besides a sponge fishery.



SNOW-CAPPED MOUNTAINS IN SOUTHERN NEW MEXICO
Photo. Gatliff



PINE RIDGE, NORTH WESTERN NEBRASKA

The forest resources of the United States have been considerably depleted during the last fifty years, and now the area of standing timber amounts to little more than one-fourth the total land area. To conserve what still remains the government has established numerous forest reserves with a combined area of over 150 million acres.

The mineral resources of the United States are exceptionally valuable and include gold, silver, coal, petroleum, iron and many of the rarer metals, including mercury and aluminum, though there is little tin. Other minerals include building stone, cement, etc.

Agriculture. The United States may be said to be roughly divided into two areas with distinctive types of agriculture. In the North Atlantic States, the farming is of the kind suitable to small independently-owned farms; in the Southern States farms are worked on the large estate system.

The chief crop produced in the United States is maize, production of which in 1935 reached a total of 275 millions of quarters. It is followed in value by oats and various forage crops. Wheat, production of which reached a total of 75 millions of quarters in 1935, is the third most important crop. Other grain crops include barley, rye, potatoes, kaffir corn, millet and durum wheat, which are grown in the more arid areas. Cotton and tobacco are, apart from maize, the main crops in the Southern States.

There are many other crops of importance such as flax, sugar cane, beet, etc. The second most important kind of farming is the cattle breeding which is carried out mainly in the Western States. There are in the United

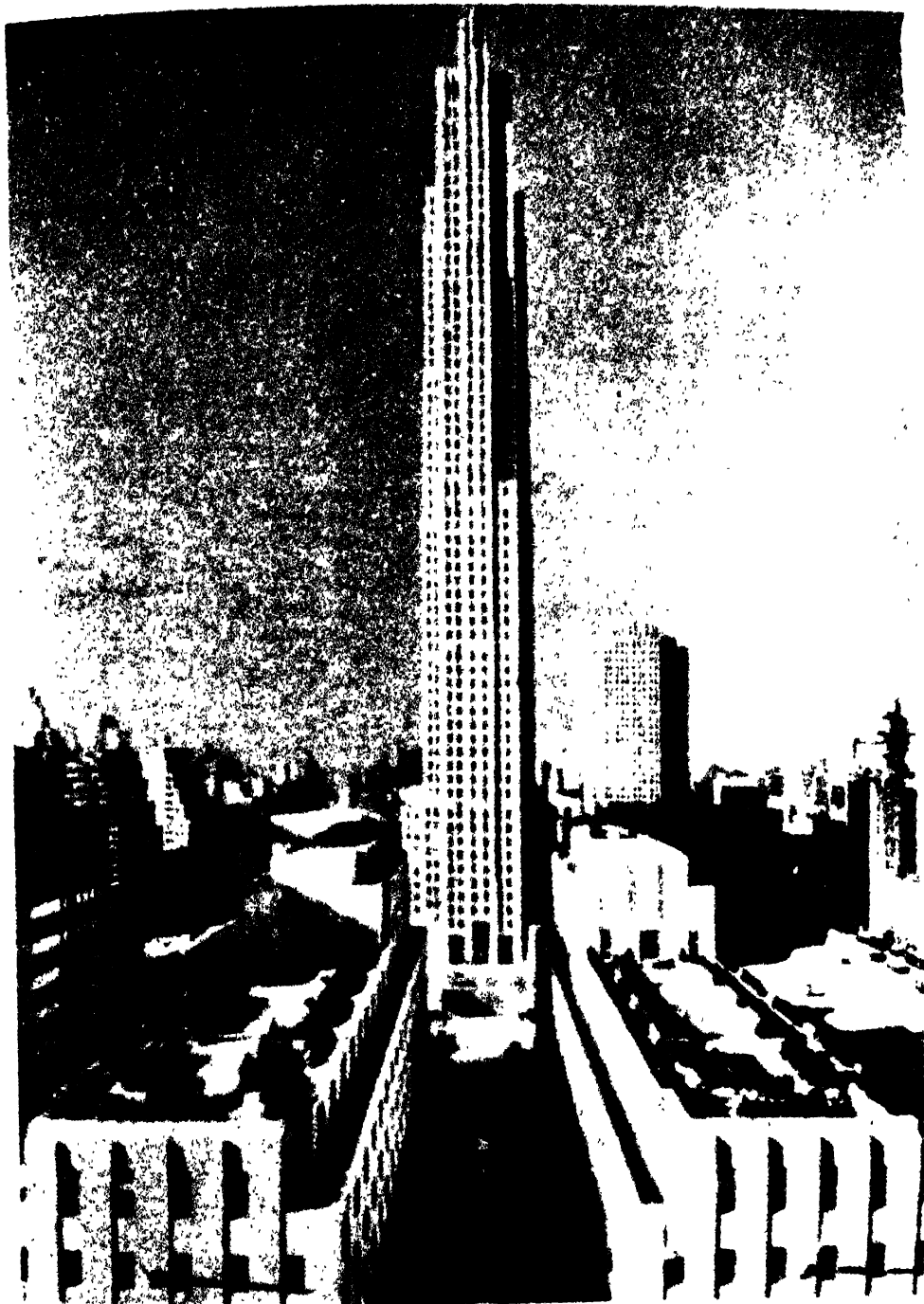
States some 67 million cattle, 51 million sheep and 11 million horses. Not all the cattle are bred for food, as the dairy industry is of growing importance, especially in the vicinity of the large towns, and in value is little below that of cattle breeding.

Fruit growing is of great value in the western and Central States and is exceedingly varied in its products, which range from the citrus fruits of California and Florida and the date palm of Arizona to all the other kinds which flourish in the temperate zone.

Transport and Commerce It was evident at an early date that the future of the country depended upon overcoming the barrier of the Appalachian Mountains. This was accomplished, first by the construction of the National Road from the Potomac through to the Ohio River in 1818, and especially by the opening, in 1825, of the Erie Canal, which brought the navigable Hudson into connection with the Great Lakes.

The work of unification was furthered by the steamboat, which first appeared on the Ohio in 1811. For more than a generation, the commerce of the United States was carried chiefly by river, lake, and canal. The first railway in the United States, the Baltimore & Ohio, was begun early in July, 1828, and opened for traffic, on a thirteen-mile stretch, in 1830. It was then operated with horse-drawn cars. Steam locomotives were first used in 1830, by the South Carolina Railway.

For many years, railways were regarded merely as feeders of the waterways and as connecting links between them. The first continuous line of railway, beginning at



ROCKEFELLER CENTRE, NEW YORK CITY

In the centre is the seventy-story R.C.A. Building. It occupies more than half of the middle block of Rockefeller Centre, between 49th and 50th Streets and Fifth and Sixth Avenues. In the foreground, at left and right respectively, are La Maison Française and the British Empire Building.

Photo: Wurts Bros.

tide-water on the Atlantic, reached Buffalo in 1842; Chicago, in 1852; the Mississippi River, at Rock Island, in 1854; and the Pacific Ocean, at San Francisco, in 1869. Meantime, in 1859, the first railway had also been opened from the Gulf of Mexico to the Great Lakes.

Later in development have been motor roads and air routes. There are now over half a million miles of surfaced roads. In 1934 half a million passengers were carried by air within the United States.

One can cross the continent in two days by the combined rail and air routes.

The mileage of the railways is now (1934) 256,418 miles. They include five trans-continental routes and are linked with the railways of Canada and Mexico. The ordinary gauge is 4 ft.

In 1935 the general export trade of America was valued at over 2,280,000,000 dollars and the import trade at 2,047,000,000 dollars. These figures were less than half those for the year 1929. In order of value the principal exports are machinery, copper goods, mineral oil, motor cars and accessories, and tobacco. Imports in order of value are wood and paper, coffee, sugar and rubber. Export trade is chiefly to the United Kingdom, Canada, Japan, France and Italy, and import trade is chiefly from Canada, the United Kingdom, Japan, Malaya and Cuba.

In recent years the once huge export of United States wheat has practically ceased.

Industries. As is natural, the oldest industries in the United States are centred in the New England States, and include furniture manufacture and shipbuilding. Other of the chief centres of industry are Chicago, Philadelphia, Detroit, and Pittsburgh. The chief industries include iron and steel manufacture, meat packing, motor-car building, petroleum refining, cotton and wool weaving and spinning, the manufacture of wearing apparel, etc.

See separate articles on the various States for further details regarding Natural Resources, Agriculture and Industry.

Government. By the Constitution of the United States the individual states, formerly separate colonies, granted to the National Government all essential powers and themselves agreed to refrain from using those powers. Certain powers, however, are reserved to the state, and it is this division of authority between the individual state and the United States that makes the latter a *Federal* government. The chief executive of the United States is the President. The law-making body is the Congress. The judicial body is the Supreme Court, together with various lower Federal Courts. The President has supreme power in that he may veto acts of Congress but, on the other hand, Congress



EAST RIVER ON THE EASTERN SIDE OF MANHATTAN ISLAND

Coastwise and South American shipping use these docks on the East River; boats to and from Europe mainly use the docks along the Hudson. The bridges are Brooklyn and Manhattan (behind).

Photo Keytones



may impeach the President for unconstitutional behaviour. The Supreme Court is the final judge of what is and what is not constitutional. Congress is composed of a House of Representatives and a Senate, both elective. The President is also elected and serves a term of four years. He may be re-elected.

History. It is disputed whether Columbus in 1492 was the first European to discover America, or whether he was preceded by Leif Ericson, the Norseman, who probably discovered the continent in the year 1000.

The earliest permanent settlements were made by the French and the first founder was Jacques Cartier, who established a settlement on the site of Montreal in 1540 (see CANADA). The French were followed by the Spanish, who formed settlements in Florida, but though many great names are associated with the colonizing activities of France and Spain, the primary object of these men was to win new territories for their kings or to convert the heathen Indian, and not to establish new and permanent homes for themselves. It was in 1607 that the first English colony was begun, when the London Company founded Jamestown in Virginia. Later English settlements were made in 1620

by the Pilgrims at Plymouth, and in 1634, when Maryland came into being through the action of Lord Baltimore. Meanwhile, however, the Dutch had founded in 1614 the colony of New Amsterdam, which was taken from them in 1664 by the English and renamed New York. Well-known names connected with the colonization of the United States are those of William Penn, who founded Pennsylvania in 1682, and James Oglethorpe, who founded Georgia in 1732. Whilst these colonies were growing there was war between France and Britain, which lasted from 1689 to 1763, when England took possession of the whole of the French territories in North America. During much of the time while this war lasted there had been fighting between the French and English forces in America, and large bodies of English troops were drafted to the defence of the new colonies. It was natural enough, therefore, that, when the cost came to be counted up, Britain should require a contribution from the colonies to the cost of their defence. Accordingly in 1764, the British Parliament passed the Sugar Act which placed an import duty on sugar and molasses, and this was followed by the Stamp Act a year later. The



MARDI GRAS CELEBRATIONS AT NEW ORLEANS
Photo: Southern Pacific



TIMES SQUARE, NEW YORK CITY

The narrow building is that of the *New York Times*. On the right, with its upper floors set back, is the Paramount Building. The central street is Seventh Avenue; the one branching off to the left is Broadway. 42nd Street crosses these at Times Square.

Photo: U. & U

colonies adopted the position that there should be no taxation without representation, and refused to meet the demands of Parliament. There were many demonstrations and the Stamp Act was repealed upon the accession of Pitt as Prime Minister, but it

was followed by further Acts imposing various duties on many commodities.

The opposition of the colonists to these taxes was expressed in such unlawful acts as the Boston Massacre of 1770 and the Boston Tea Party of 1773, when 340 chests



ASHEVILLE, NORTH CAROLINA, FROM THE HILLS

of tea were thrown into the harbour. Coercive measures adopted by the Government did nothing to check the open resentment of the colonists, and a Continental congress in 1774 met to support the actions of the colonists of Massachusetts, in spite of the fact that Britain, foreseeing the possibility of armed rebellion, was pouring troops into the country. So matters stood in 1775, when in April there was a skirmish between the troops of the British garrison and the American colonists at Lexington, Massachusetts. It was the first act of the war and the colonists began immediate organization on a large scale. Their troops met the British at Bunker Hill in the first battle of the American Revolution (which see).

When the War began the colonists were seeking rather to establish their rights, as they saw them, than to set up an independent government. As the War progressed, however, they ceased to utter professions of loyalty to the Crown, and on 4th July, 1776, they proclaimed the famous Declaration of Independence. In spite of this declaration the States retained their separate sovereignty and independence of one another until 1781, when Articles of Confederation were finally ratified. It was realized by the more far-seeing statesmen, that the central Government as set up by these Articles was not ideal, for it lacked the powers necessary for the proper working of any centralized authority. The States, jealous of their new-won rights, refused to grant it

any power of taxation, and, in regard to legislation, every law had to be ratified by the nine States before it became operative.

What the more far-seeing statesmen had already gathered others had to learn by experience, but they were not long in doing so, and a Convention was held in 1787 at Philadelphia to draw up a new constitution. There were many divergencies of opinion as to the form it should take. The plan finally adopted gave equal representation in the Senate and representation on a basis of population in the House of Representatives. Power was divided between State and central Government in a more equitable manner than previously, and it was stated that any power not granted to the new Government should be reserved to the States. This Constitution was approved by the various States between 1787 and 1790, Virginia being the first State to signify its approval and Rhode Island the last. In 1789 George Washington was elected the first President.

It was of inestimable benefit to the new country that its first President should be one of such prestige and ability, for by his personality he enhanced the position of the central Government. During his second administration, which began in 1793, Washington had need of his great abilities, for America was immediately involved in difficulties with both Britain and France. By a proclamation of neutrality he was, however, able to keep America out of the war

except for a few naval encounters between American and French ships.

The years until 1806 were years of consolidation and expansion, for during them America purchased Louisiana from France and established a claim to Oregon. On the expiration of the Jay Treaty in 1806, America refused to accept the new treaty proposed by Great Britain, for it contained clauses regarding the shipment of goods to France which America would not accept. The situation was further complicated by Napoleon's Berlin Decree blockading Britain, which he could not enforce, and Britain's blockade of France and her allies which she was able to enforce. America sought to withdraw herself from these European troubles by certain Acts which forbade intercourse between her and warring countries, but, in fact, the chief result of these Acts was to cripple American trade. These troubles led to strained relations between Britain and the United States which were made worse by the impressment of seamen belonging to American ships for service in the British Navy, and in 1812 America declared war. See WAR OF 1812.

The outcome of this war brought America no material prizes, but it gave her something which she had until that time lacked, a true feeling of nationalism, which found

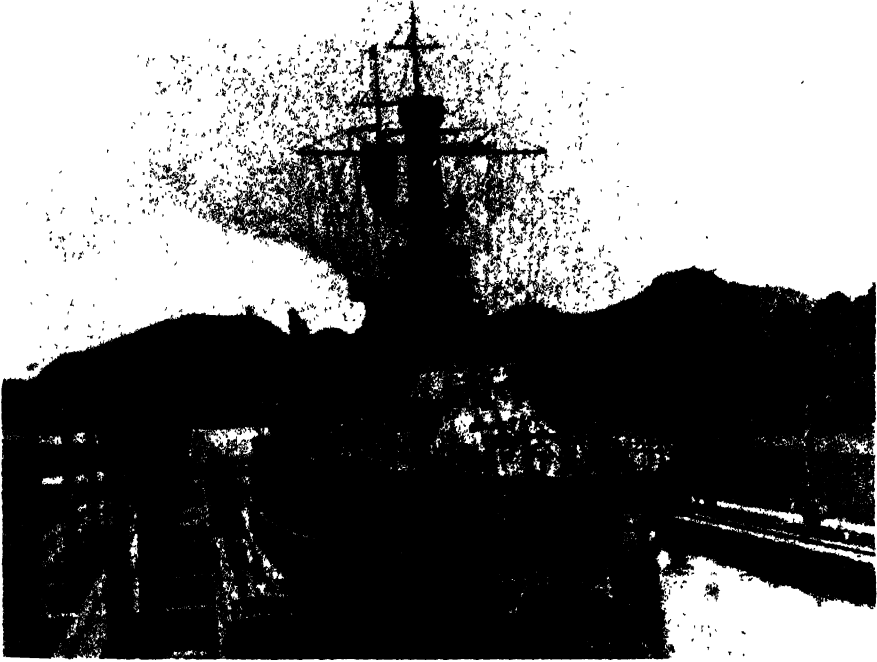
expression during the presidency of Monroe (1817-1825) in the promulgation of the Monroe doctrine (which see).

During the years which followed, America consolidated her position as the dominant Power of the Continent, and many new states entered the Union. This period of growth was not checked by such incidents as the Mexican War, for victory was soon gained and brought with it the addition of valuable territory. There were, however, internal divergencies on matters of principle which caused disagreement between the states, and the unity achieved in the face of British opposition appeared at an end. The chief matter in dispute was the slavery which existed in the Southern States. The North, which was mainly a country of small farmers, had no negro population and had imbibed deeply of the teachings of Thomas Paine and the French revolutionary leaders. It stood for the equality and freedom of every man. The South, a land of great estates, had a long tradition of slave ownership, and, in fact, the slaves numbered in 1854 some four million out of the total population of twelve million. The freeing of the slaves would, in the opinion of most of the leaders of the South, bring about economic ruin and social disturbance.

The election of 1860 was fought on the



BAN AT NADIN ON THE YADKIN RIVER
P & A.



AMERICAN WARSHIP PASSING THROUGH LOCKS IN THE PANAMA CANAL

Photo. P. & A.

question of slavery or no slavery and resulted in the election of Abraham Lincoln, the Republican candidate who stood for anti-slavery.

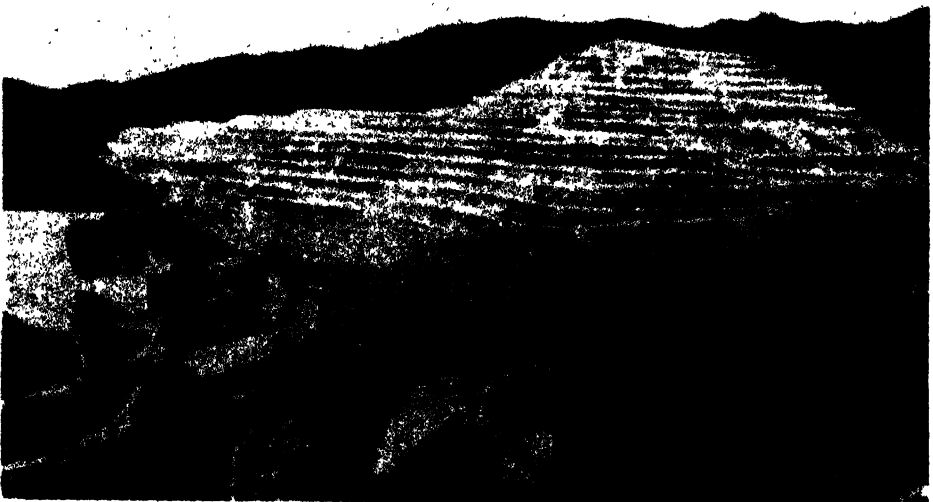
The South was determined not to accept dictation in this matter, and led by South Carolina, the states of Mississippi, Florida, Alabama, Georgia and Louisiana, formed in 1861 a government known as the Confederate States of America, to which Texas, Arkansas, Virginia and North Carolina were admitted later in the same year. Lincoln was determined that there should be no break up of the American Union and decided on war. An international incident during this war was the Trent Affair of 1861, when a northern warship boarded the British steamer *Trent* and arrested a delegation from the Southern States. This nearly led to war between Britain and the Federal Government, but a vigorous dispatch of Russell, the Foreign Secretary in Lord Palmerston's government, was tactfully amended by Albert, the Prince Consort, to provide the Federal Government with an opening for explanation. See WAR OF SECESSION.

The unlimited resources of the new coun-

try and the need that Europe had for the goods she was able to produce brought abundant prosperity to America. She was, however, a new country with but few traditions, and she suffered from the predatory activities of many unscrupulous politicians. Such scandals as the so-called "Salary Grab" of 1873, when Congress voted itself increased salaries for past services, the resignation of W. W. Belknap, a Secretary of War, in order to avoid impeachment, and the exposure of the Tweed ring in New York, showed that all was not well in the political life of the country. Landmarks during these years were the Anti-Polygamy Law, aimed at the Mormons, and the Chinese Exclusion Act of 1882, which restricted their immigration into the United States. Both these, however, are of lesser importance than the Sherman Anti-Trust Act of 1889 (see TRUSTS). The years 1898 and 1899 saw the annexation of the Hawaiian Islands and some islands of the Samoa group including Tutuila, but the most important event of this time was the Spanish-American War which brought with it the acquisition of Cuba, the Philippine Islands, and Puerto Rico. See SPANISH-AMERICAN WAR.

The imperialistic spirit which led to the annexation of these territories had its critics in America, but the Republican Party behind President McKinley was in the ascendant, and was determined to maintain and enhance the influence of the United States in the world. McKinley was succeeded by Theodore Roosevelt, during whose Presidency the United States gave protection to Venezuela and Santo Domingo, and negotiated a treaty with Panama for the building of the Canal. During this and later administrations, relations between the United States and the various countries of Europe improved considerably, for America began to realize that, with the growth of transport, she could no longer stand in isolation. She did, however, endeavour to preserve her position of isolation when the World War broke out in 1914, and with the aid of President Wilson she succeeded until April, 1917, when she was forced to declare war against Germany. In 1918, when the War ended, America's prestige was higher than it had ever been before, or has been since, and it was undoubtedly the enthusiastic support which President Wilson gave to the project of the League of Nations (which see), that led to its establishment. Although a great idealist, Wilson did not prove himself an astute statesman, and he was unable to put an end to the intrigues which led to the rejection by Congress of American membership of the League. Except for trade rela-

tions America was determined to return to her isolationist policy. The years following the World War, after a slight industrial depression, saw a great increase in American world trade, which reached its peak in 1929. At the end of this year, the frantic speculation which was the chief foundation of the American prosperity ceased abruptly, and there was a dramatic fall in prices on the Stock Exchange. This stock market crash marked the beginning of an industrial depression which extended over several years, and led to much unemployment and accompanying hardship. It was not until the election of Franklin Roosevelt, the Democratic candidate, in 1932, that the downward trend of trade was checked, and the people began to regain their confidence. During Roosevelt's first administration he showed courage in adopting many experimental schemes to bring about a return of prosperity. Some of these were later discarded, either because they proved unsuccessful, or because they were declared unconstitutional by the Supreme Court (see NATIONAL RECOVERY ACT). Though the return to prosperity was slow, it was none the less obvious, and because of Roosevelt's success in this, and the universal approval of his foreign policy, which favoured bi-lateral trade pacts, but withdrew the United States from any possibility of entanglement in European disputes, he was elected for a second term in 1936.



OPEN-CUT COPPER MINE IN UTAH

Eighteen terraces are being worked in what is claimed to be the world's largest open-cut copper mine situated less than thirty miles from Salt Lake City

UNITY. In theology, the term Unity is used to express the Oneness of the object of our supreme reverence, as seen in the Christian doctrine of the Trinity - a three-fold embodiment of one Divine will and character; three in One, and yet not three Gods, but one God. See **TRINITY**.

The term has also an essential connection with the system of Neo-Platonism which originated in Alexandria in the third century. As expounded by Plotinus, its founder, Neo-Platonism is based on a conception of that supreme Unity which is the source of all existences and all knowledge. While, in Plato's system, the supreme factor is the idea of the good, in Neo-Platonism the ultimate Unity is raised above even the ideal world. This Unity, or One, is inaccessible to knowledge, no matter how ideal. God is not Being or Mind. He is Over-Being, Over-Mind, and the only attributes that belong to Him are Unity and Goodness. If man is to rise to any conception of God at all, it must be by some kind of intuition, or in a state of ecstasy, in which he is absorbed into the Divine Being.

UNIVALVE. A class of molluscs. See **MOLLUSCS**; **SHELL**.

UNIVERSITY. In medieval times the university idea was initiated by the few learned men, leaders of the social systems as well as men of great knowledge, who talked on the conditions and culture of their day to all those of serious mind who desired to learn wisdom from their teachings. No date can be fixed for those beginnings of a movement which has developed throughout the ages and operates to-day with ever-increasing necessity, usefulness, and power. The universities became definite foundations with the Christian era. They have developed as corporations of teachers and students, ever leading thought, knowledge, and culture.

The earlier universities were essentially ecclesiastical institutions with studies, privileges, and administrations controlled and directed and guarded by the ecclesiastical authorities.

At Salerno, in Italy, a university, which had become famous throughout the then known world by the beginning of the eleventh century, was founded principally for the furtherance of medical science. A School of Law was established at Bologna in the twelfth century, and in 1158 Frederick Barbarossa gave that university special privileges which made it prosperous and as famous as that at Salerno. So great became the reputation of these two universities that in the early Middle Ages only the University of Paris ranked with them. The distinctive courses of instruction given became known as Faculties, and the Faculty of the Law

became as notable as that of Medicine at the Italian institutions. The practice of the law, then as now, often brought wealth and great honours. In the thirteenth century the universities chose Rectors as their chiefs, the members of the universities electing these by their votes. The Rectors controlled the administration; the Professors the teaching.

Not until the fourteenth century did colleges on the lines of those in Paris and Bologna come into being in Britain, yet before the fifteenth century Oxford was recognized as the leading university of the world. The Scottish universities were established during the Middle Ages—St. Andrews in 1411, Glasgow in 1450, and Aberdeen in 1491. An attempt to found a university in Dublin in 1312 was unsuccessful, and the modern Dublin University was not established until 1592.

From the sixteenth century onwards the teaching scope of the universities changed considerably in accordance with the broader mentality of the time. The most progressive in later centuries in what may be termed the "popular" nature of the studies were the Scottish universities. During the nineteenth century the rate of progress was rapid. Broader knowledge and ever-growing needs brought a wider range of studies. Religious tests were abolished, women in the twentieth century have been given the privileges of the universities.

UNKNOWN SOLDIER. As a special tribute to the men who died in the World War, Great Britain, France, Belgium, Italy, and America each interred the body of an unknown soldier in a special shrine at their respective capitals. In London the tomb is in Westminster Abbey, Paris, beneath the Arc de Triomphe, Brussels, beneath the Colonnade of Congress; Washington, in the Arlington National Cemetery.

UNLAWFUL ASSEMBLY. When three or more persons meet together with the intention of carrying out any common purpose, which is likely to involve the use of violence or to produce in reasonable men a fear of violence, they are guilty of the misdemeanour of *Unlawful Assembly*, even though they depart without taking any step toward carrying out their purpose. The essence of this offence lies in the likelihood of violence or of causing alarm to people who are not unreasonably nervous.

When the members of an unlawful assembly take any step towards the carrying out of their common purpose, their offence is called a *Riot*, and when they reach their goal and begin forcibly to carry out their purpose it is called a *Riot*.

The Riot Act of 1715 provides that, if an

unlawful assembly of twelve or more persons does not disperse within an hour after a Justice of the Peace has read or endeavoured to read to them a proclamation in stated terms (this is often incorrectly described as "reading the Riot Act"), the persons remaining become guilty of felony punishable with penal servitude for life, and any necessary force may be employed to disperse them.

UPERNIVIK, *u' per nee vik*. See GREENLAND.

UPOLU. See SAMOA.

UPPINGHAM. See RUTLAND.

URAEMIA, *u' re' mia*. A poisonous condition of the blood, caused by loss of function of the kidneys in certain diseases. It is due to the circulation in the blood of waste products that should be eliminated by the kidneys, and perhaps of other products which should not be manufactured at all. It is closely allied to *Eclampsia*, a dangerous complication of childbirth. Unless the underlying condition of the kidneys can be successfully treated, it is usually fatal. The symptoms are headache, giddiness, drowsiness, scanty urine, and the characteristic convulsions, which occur when the uraemia is well established.

URAL MOUNTAINS. See RUSSIA.

URANIA, *u' ray' nia*. The one of the nine Muses who was known as the patron of astronomy. As usually depicted in art, she holds a globe in one hand, and in the other a rod with which she traces out some figure. See MUSES.

URANIUM, *u' ray' nium*. A rare metallic element related chemically to chromium, molybdenum, and tungsten. Its atomic weight of 238.2 is greater than that of any other metal. Uranium is a white, moderately hard, malleable metal, softer than steel, and more than eighteen times as heavy as water. It is never found native, but occurs in several ores, notably in pitchblende and carnotite. The salts of uranium are used as pigments in glass and porcelain manufacture. It is claimed that, as an alloy for making high-speed steels, it practically equals tungsten. The metal possesses marked radioactivity, and is the parent of radium. Its symbol is *U*. See CHEMISTRY; RADIOACTIVITY.

URANUS, *u' ray nus*. One of the major planets, seventh in distance from the sun, discovered accidentally by Sir William Herschel in March, 1781. Uranus is barely visible to the naked eye, and appears as a star of the sixth magnitude. It is about 1,782,000,000 miles distant from the sun, around which it revolves in eighty-four of our years. Peculiarities in the motion of Uranus led to the discovery of the planet Neptune in 1846. See NEPTUNE.

Satellites of Uranus. Four attendant satellites accompany Uranus, namely, Ariel, Umbriel, Titania, and Oberon. Herschel himself discovered the last two in 1787. The others were discovered in 1851 by Lassell. The satellites are never visible to the naked eye, and can be detected only by the most powerful telescopes. A notable characteristic of these satellites is that they move from east to west, in the opposite direction from most solar bodies.

URANUS. In Greek mythology the name of the most ancient of the gods, the personification of the sky, which bestows light, heat, and moisture upon the earth. He was the husband of Gaea (Earth), and father of the Cyclopes, the Titans, Rhea, and the hundred-handed giants. Uranus was deposed from his throne by Kronos, the youngest of the Titans, and killed, from his blood sprang the Furies. He is represented in art as an old man, bearded and holding over his head a robe stretched out like an arch.

URBAN. The name of eight Popes, of whom the most important were Urban II, Urban VI, and Urban VIII.

Urban II, Pope from 1088 to 1099, at the commencement of his Papacy defeated Guibert of Ravenna, who, under the name of Clement III, claimed the Papal chair as the candidate of the Emperor Henry IV of Germany. At the Council of Clermont, in 1095, he urged the First Crusade as he afterwards supported the later Crusades. The Crusaders, passing through Italy, drove the antipope Clement III from Rome, and established Urban firmly on the Papal throne.

Urban VI, Pope from 1378 to 1389. His predecessor, Gregory XI, had brought back the Papal seat from Avignon to Rome, but the French cardinals were unwilling to agree to the transfer, and accordingly elected a candidate of their own, who was proclaimed Pope at Avignon as Clement VII, while Urban took his seat at Rome, appointed twenty-six new cardinals, and excommunicated Clement and his adherents. The so-called Great Schism, or Western Schism, which resulted, continued for almost half a century.

Urban VIII, chosen Pope in 1625, reigned for twenty-one years. An enlightened, forceful ruler, he was criticized for the preferences which he bestowed upon members of his own family. He upheld firmly the temporal powers of the Papacy. Richelieu strongly opposed his policies, but in the end an agreement was entered into between the two, and in the Thirty Years War, the Pope supported France against Spain and the Holy Roman Empire.

URBAN DISTRICT. An area of local government larger than a Rural District

and less than a Borough. For particulars of the powers of the Urban District Council see DISTRICT.

URD. See NORNIS.

UREA, *û' re a.* See KIDNEYS; LIVER; URAEMIA; URINE.

URETERS, *û' re' torz.* See KIDNEYS, URINE.

URETHRA, *û' re' thra* See KIDNEYS, URINE.

URIC ACID. Chemically an organic acid, certain salts of which occur in small quantities in the urine of mammals. In man 7 to 10 grains are excreted in 24 hours, accounting for one-fiftieth of the total nitrogen excreted; the rest of the nitrogen occurs in the form of *urea*. In birds and reptiles, on the contrary, nearly all the nitrogen is excreted as uric acid, which forms a large proportion of the material of guano deposits.

URINE, *û' rin* A fluid waste product of the body, separated from the blood by the kidneys. Blood is carried to these filtering organs through the *renal artery*, and the waste matter drawn from them is carried to the *bladder* through two small tubes called *ureters*. The fluid is expelled from the body through a canal called the *urethra*, which leads from the bladder.

In health, the urine is a slightly acid, amber-coloured liquid, somewhat heavier than water, its average specific gravity is 1.022. It is made up of water, in which are dissolved *urea* (a nitrogenous substance), ammonia, salt, and small quantities of other substances.

UR. An ancient city of Chaldaea (which see), recently excavated by Dr. Woolley's expedition. Remarkable finds were made.

URSA MAJOR. A Latin phrase meaning "greater bear"; the name of the conspicuous northern constellation commonly known as the Great Bear. The well-known Plough is a portion of it. *Ursa Minor* (lesser bear) is the name given to the Little Bear, a neighbouring constellation.

URSULINES, *ur' zû linz,* OR NUNS OF SAINT URSULA. A Roman Catholic sisterhood, established at Brescia, Italy, in 1535, by Angela Merici. The members entered the community for the purpose of caring for the sick and needy, instructing the young, and receiving training in holy living. In 1574 the Ursuline nuns entered France, and in 1611 a large convent was built for them near Paris. The order grew rapidly and spread to most European countries and to America. The total number of Ursuline sisters in all countries at present is about 4500.

Saint Ursula, *ur' zû la.* According to a medieval legend of the Roman Catholic Church, Ursula was a virgin from Britain who, with eleven companions, was martyred

by the Huns at Cologne, while the maidens were returning from a pious pilgrimage to Rome. By a probable error in translation, the number of the maidens was later multiplied by one thousand.

URTICARIA, *ur ti kair' ria* (from the Latin word for *nettle*). The scientific name for *nettle rash*. The term is used because the affection is sometimes caused by the irritating poison of the stinging nettle (*Urtica dioica*). Acute urticaria is often caused by tainted food, though usually it results from eating food which for one reason or another is not properly digested.

URUGUAY, *û' ru gwai.* This South American republic takes its name from the great river which borders it on the west. It has an area of 72,153 sq. miles and a population in 1935 of 2,020,040.

The People. The people are almost entirely of pure European descent, chiefly Spanish and Italian, though there are many Germans and French. The purely Spanish element, long dominant, has impressed the speech and manners of Spain upon the country. The native Guaraní Indian population has almost completely disappeared, and the negroes and mestizos, or half-breeds, form a very small proportion of the people.

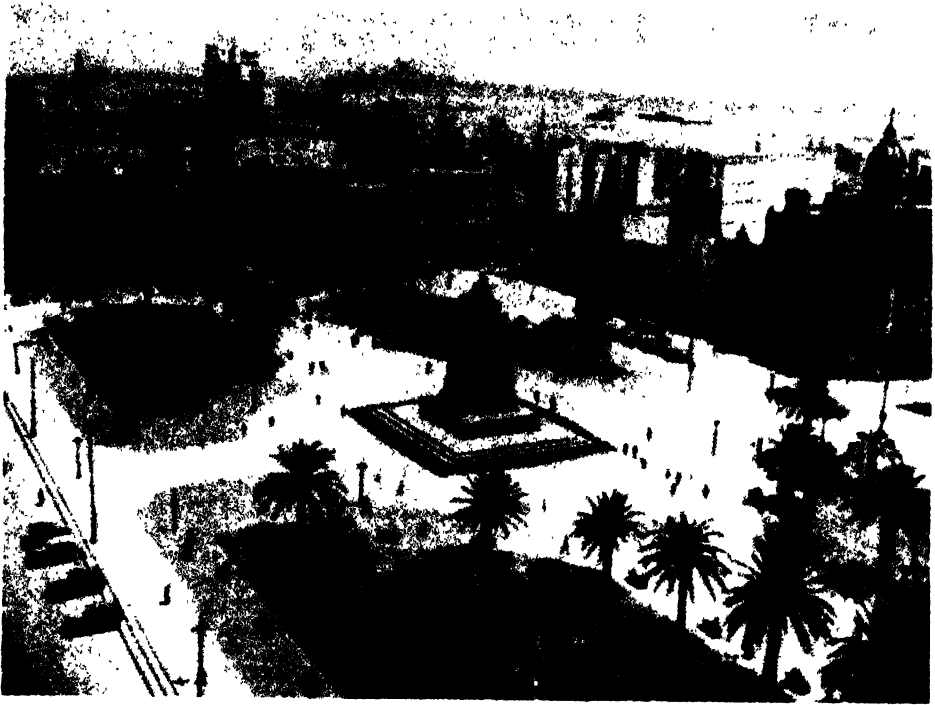
The Cities. There are only about one hundred towns and villages of which the largest are Paysandu (31,000), Salto (30,000), Mercedes (23,000), and Montevideo, by far the largest.

Montevideo, *mon lay te day' o,* commonly, *mon te vid' eo,* is the capital and principal seaport. It is 120 miles east-south-east from Buenos Aires, and faces the Rio de la Plata. The city was founded in 1726, though the Portuguese had established there a small fortress in 1717.

It is a modern city built of brick or stone, in the European style. The buildings include the cathedral, dating from 1804, a national museum and a university, etc.

The principal industry of the city is meat packing and its many subsidiaries, and several large American packing houses have branches here. The harbour, which was originally shallow and exposed, was dredged and deepened, and breakwaters were erected. Population, 666,130 (1933).

Physical Features. Uruguay has a mild and moist climate. The temperature ranges from about 55° to 72°, and the annual rainfall averages 37 in. For the most part, the land is a rolling prairie with vast pasture lands, varied in the northern hills and along the many rivers and lakes by woods of pine and palm. A range of low mountains at the north varies the plain, and in the valleys between the ridges, there is fine pasturage for stock. On the west the land slopes to the



MONTEVIDEO

Plaza Independencia. The port is in the background and in the centre background the Ca (hill) crowned by the fort.

Photo: Royal Mail Lines

Uruguay River, on the east to the Atlantic. The coast is low and sandy and fringed by lagoons.

Production and Commerce. Sixty per cent of the total area is devoted to stock-raising, and less than 7 per cent to crop production. It is estimated that there are on the ranges and ranches at least 7,500,000 head of cattle and about 20,500,000 sheep, which produce generally a good grade of wool. Of the crops, wheat, maize, flaxseed, oats, barley, alfalfa, linseed, and bird seed are important. The vine and the olive are cultivated. Tobacco is yearly increasing in importance. Agriculture is receiving more attention, and many of the grazing lands will become cultivated fields.

Talc is mined; copper, lead, silver, and manganese are present, but are little worked.

There are few factories because of lack of fuel. Meat packing and distilling are of considerable importance; the output of the flour mills, shoe factories, furniture, brick, tile, cement, and glass factories, and woollen mills is only great enough to supply the local demands.

Communications. Commerce is aided by

over 1700 miles of railway, supplemented by about 6000 miles of highway and an extensive river transport. Trade is chiefly with Great Britain, the Argentine, and Germany.

Government and Education. The Government consists of a Senate of thirty members, one from each department, elected for four years; and a General Assembly of ninety-nine members elected for four years. The President is elected by ballot for four years and has a Council of Ministers. The present Constitution dates from 1934.

Primary education is free and compulsory. A state university at Montevideo, schools for the defective, a school of arts and trades, a military college, and a National Agricultural Institute are maintained by the government.

The majority of the inhabitants are Roman Catholic, but absolute religious freedom exists.

History. Uruguay was visited by the Spaniards under Juan de Solis in 1516, but Spain did not take possession until a century later. In 1750 Uruguay became a separate dependency of the Spanish crown.

Uruguay was a source of dispute between Spain and the Portuguese of Brazil, and was the scene of intermittent conflicts in the eighteenth century. Finally, the people won their freedom, first from Spain in 1825, then from Brazil three years later. Its history, however, was long a record of internal contention. Besieged by the Argentines, Uruguay fought for its existence from 1843 to 1852. Later, the country, allied with Brazil and Argentina, spent five years (1865-1870) resisting the encroachments of Paraguay.

The Uruguayans refer to themselves as *Orientales*, from a name that appears in the official title of the republic.

In October, 1917, Uruguay severed diplomatic relations with Germany, and expressed itself in sympathy with the Allies. Uruguay is a member of the League of Nations.

USURY, *u'zhūri*. Broadly, the lending of money at interest; more particularly, and as commonly used, the word means the lending of money at excessive interest. In English law, a long series of Acts of Parliament, generally known as the Usury Acts, formerly prescribed from time to time the maximum rate of interest that might lawfully be charged. These Acts were never very effective, and they have now been re-

pealed, their place being taken by the special laws relating to moneylenders. See **MONEY-LENDER**.

UTAH. A state lying between the Rocky Mountains and the Sierra Nevada, with an area of 84,990 sq. miles, of which 2806 sq. miles are water. The population numbered 507,847 in 1930.

Nearly one-half of the total number are urban dwellers. The chief cities are Salt Lake City, the capital (population 140,267); Ogden, Provo, and Logan. About 91 per cent of the total church members belong to the Mormon Church.

Utah is a great plateau covered with sagebrush and broken into lofty mountain ranges. The two chief ranges are the Uinta Mountains, forming a great barrier along the eastern half of the northern boundary, and the Wasatch Mountains, crossing the centre of the state from north to south. Among the summits several rise to more than 13,000 ft. above the sea.

East of the Wasatch Range and south of the Uintas, lies the Colorado Plateau. West of this backbone of mountains lies the Great Basin, a region of arid valleys separated by steep, island-like mountains. At the foot of the snow-covered peaks, the valleys are



BIRD ISLAND, GREAT SALT LAKE, NEAR OGDEN, UTAH

fertile, but a region of about 4000 sq. miles west of Great Salt Lake is barren, and is known as the Great Salt Lake Desert.

The principal river is the Colorado, which is joined by the Green River in the eastern part of the state. The Jordan River flows from Utah Lake into Great Salt Lake.

Great Salt Lake and the smaller lakes of the region are the remnants of a fresh-water lake, Lake Bonneville, which at one time covered a great basin of 19,750 sq. miles. Utah Lake remains fresh, because it flows into the Great Salt Lake, and its waters are constantly changing.

Agriculture and Industry. Agriculture, the only industry of Utah's early years, is still, to-day, equal in importance and value with mining. Wheat, sugar-beet, and potatoes are raised extensively on irrigated land. Barley, rye, and wheat, and in the most favourable places other crops, are successfully grown in irrigated regions. The north-central part of the state is noted for its apples, cherries, and peaches.

The national forests cover over 7,400,000 acres; they contain about 95 per cent of the woodland area of the state, and furnish most of the summer grazing grounds for livestock. Extensive deposits of coal exist in the eastern slopes of the Wasatch Mountains. Copper, lead, silver, gold, and zinc are the chief metals. Asphalt and rock salt are also extensively produced. The great iron deposits have only recently been developed and a smelting plant erected.

The leading industry is the smelting and refining of copper and lead ores. Beet-sugar manufacture, canning and preserving, the milling of flour and other grain products, slaughtering and packing of meat, poultry-raising, and dairying, are industries based on products of Utah's farms and ranges. Textile, cement and lime factories, and saw-mills are also numerous.

UTILITARIANISM, *ú til i táir' ian iz'm*. A doctrine of ethics which adopts, as the criterion of right and wrong, the happiness of the greatest number of the human race. Utilitarians believe that an act is good or evil only to the extent that it proves itself serviceable or detrimental to the welfare of society. The word *utility* was first used in reference to this system by Jeremy Bentham, but John Stuart Mill (see **MILL**) first definitely stated the theory. Others influenced by the system were Spencer, Locke, and Hobbes. Modern philosophy shows a growing tendency to revert to the doctrine which is deduced from the position that happiness is the only intrinsically valuable attribute of mankind.

UTRECHT, *ú trékt'*. See **NETHERLANDS**, **THE**.

UTRECHT, PEACE OF. The name generally given to a series of treaties entered into at the close of the War of the Spanish Succession. Agreements signed at Utrecht in 1713 were supplemented by the Treaty of Rastadt, concluded between Austria and France in 1714, and by the Barrier Treaty of 1715, signed by Austria, England, and the Netherlands. The principal terms of the Peace of Utrecht were as follows: France agreed that the crowns of Spain and France should never be united under one ruler, and it ceded Nova Scotia, Newfoundland, and the territory about Hudson Bay to England. Spain ceded Gibraltar and the island of Minorca to England, Sicily to the Duke of Savoy, and Milan, Naples, the island of Sardinia, and the Catholic Netherlands to Austria. Holland was permitted to garrison eight towns on the frontier of the Austrian Netherlands as a barrier against French aggression.

The Peace of Utrecht marked the beginning of England's colonial and commercial supremacy, and the recognition by France of the right of the House of Hanover to the English throne. It also opened the way to the development of union among the territories that, in the next century, became united Germany and united Italy, while France was, to a certain extent, hemmed in by the expansion of former enemies.

UVULA, *ú vú lá*. See **PALATE**.

UZBEKISTAN OR UZBEK. Soviet Socialist Republic in Russian Central Asia, north of Afghanistan. It was created in 1924 and admitted to the Soviet Union in 1925, as an administrative unit. It includes the oasis of Khiva, or Khorezm, Samarkand, and most of the former khanate of Bokhara, with the Ferghana Valley. Thus a large part of the territory long known as Russian Turkistan is now the Uzbek Soviet Socialist Republic. The total area of the republic is 66,392 sq. miles, and the population is about 5,044,300.

Khiva and Bokhara were nominally independent vassal states of Russia until the revolution of 1917. After that year, they declared themselves independent republics, and their independence was recognized in treaties with the Soviet government in 1920 and 1921. Civil war and disorder followed, in consequence of the intense religious feeling of the Mohammedan peoples of these regions, until finally, in December, 1924, the two republics disappeared and were merged in the Uzbek S.S.R. The Uzbeks themselves are divided into about eighty tribes, and there is no unity of feeling as yet among the people of the republic.

Uzbek as a whole is a land of farming, based on artificial irrigation. Cotton-growing has been developed, and the republic also

produces fruits, wool, and silk. There are over fifty factories for cotton-spinning.

The Cities. The largest cities of the Uzbek republic are Samarkand, Tashkent, Khiva, and Bokhara.

Samarkand, *sam ar kant'*, former capital of the Republic, and of the territory of the same name, lies about 140 miles east of Bokhara, on the Transcaspian Railway. The city occupies the site of ancient Marakanda.

The original city, which is still partly enclosed by the old wall, contains several famous mosque schools and a mausoleum, within which are the tombs of Timur and his family. There is a considerable trade in cotton, rice, silk, gold and silver wares, pottery, and wines. Population, 154,600 (1933).

Tashkent, or Tashkend, the largest city in

Asiatic Russia and the former capital of Russian Turkistan, now the capital of the Uzbek Soviet Socialist Republic, lies in the valley of the Chirchik river. It is a centre

for the shipment of merchandise to Bokhara, Persia, Kashmir, and India, and it has railway connection with Krasnovodsk, on the Caspian Sea, and with Orenburg, on the Trans-Siberian Railway. Population, 491,000 (1933).

Khiva, *ke'va*, was formerly the centre of a flourishing kingdom of great antiquity. It now has less than 20,000 inhabitants.

Bokhara, *bok kah'ra*, or **Bukhara,** has for ages been a

famous caravan centre with a trade in silk, wool, carpets, cotton, and livestock. It now has rail connection with European Russia. Population, 40,000.



IN UZBEK

Nearly half the population is unable to read and therefore communal study of the newspapers is common

Photo Russ

THE WORLD BOOK

Vv

V. The twenty-second letter of the English alphabet. There was no corresponding letter in the Phoenician alphabet, from which later ones were derived. The letter which resembled *v* in form had both a vowel and a consonantal sound, but it now represents the vowel and *v* the consonant. In Latin, the *V*, as well as the rounded *U* form, was used, but no distinction was made between them in early times, and even in English, after the *v* sound had become well established, the two letters were used interchangeably. Not until the seventeenth century were the two permanently differentiated. In phonetic value, *v* is closely related to *f*, and in allied languages, the two are often confused. In the Anglo Saxon, there was no symbol for *v*, the letter *f* representing both sounds.

VACCINATION, *vak sin ay' sh'n*. A form of inoculation practised generally in civilized countries for the prevention of smallpox. The principle upon which vaccination is based is that, if the individual acquires the disease in a mild form, anti-bodies for the prevention of the ailment will be manufactured in his own blood, and render him immune to attacks of real smallpox for a number of years. The process consists of rubbing, scraping, or injecting into the skin, virus (vaccine) taken from the pustules formed on the abdomen of a healthy cow which has been inoculated with disease germs.

The person vaccinated undergoes an attack of cowpox, or *vaccinia*, which is the cow or horse variety of smallpox. The region infected becomes sore and swollen, and a vesicle containing a clear fluid forms. A crust then forms over the sore, which, if not pulled off through scratching, will drop off in about two weeks, leaving a scar. Vaccination came into general favour through the efforts of Dr. Edward Jenner, about 1803.

VACCINE. See above.

VACUUM, *vak' u um*. A term meaning emptiness, it is applied strictly to a space containing absolutely nothing. Generally, a space from which most of the air or gas has been eliminated is termed a vacuum. The nearest approach to absolute vacuum which has ever been attained, is to reduce the air

pressure in closed vessels to about one ten thousand-millionth of normal atmospheric pressure.

A vacuum permits the entrance of water or any other substance. The common wet pump, the vacuum cleaner, and the intake of an automobile motor are constructed on this principle. The thermos flask is constructed on the principle that a vacuum will not conduct heat. Sound will not be carried through a vacuum.

VACUUM CLEANER. An apparatus for removing dust from interior walls, floors, shelves, fabrics, and house furnishings by suction. It consists of some form of suction fan or air-exhausting pump which creates a partial vacuum (see **Vacuum**), causing air to pass into the space by pressure. The air thus drawn in carries dirt with it, and thus cleans the surfaces over which the machine passes.

The most recent development is a small portable machine which may be attached by a convenient length of insulated wire to an electric socket or outlet for current. In this form, the motor and suction fan are placed just above the slot-shaped nozzle, which slides on rollers, and the dust passes into a removable bag of closely woven material, through which the air escapes, the dust being retained.

VADUZ, *vak' duolz*. Capital of Liechtenstein (which see).

VALENCIA, *vá len' shia*. See SPAIN.

VALENCY. See CHEMISTRY.

VALENS, *vay' lenz* (about 329-378). A Roman emperor of the East, brother of Valentinian I, who made him his colleague in 364, and gave him as his territory Thrace, Asia, and Egypt. The reign was notable for repeated struggles between the Eastern Empire and the Goths.

The first struggle (366-369) closed with a treaty which made the Danube the boundary between Gothic and Roman territory, but in 376 Valens permitted the Goths to cross the Danube and settle in Moesia and Thrace. Later, hostilities recommenced. On 9th August, 378, the two armies met near Adrianople, and the Goths gained a complete victory, Valens and about two-thirds of his soldiers perishing on the field. After this battle, the Goths established themselves permanently south of the Danube.

VALENTINE, SAINT. The name of several saints and martyrs of the Christian Church, of whom, the most celebrated are two martyrs whose festivals fall on 14th February. One was a priest at Rome and the other a bishop in Umbria. The most reliable accounts seem to show that both lived in the third century and died on the same day. The traditional anniversary of their death has become known as *Saint Valentine's Day*. The custom of sending love tokens, etc., on this day is, it is suggested, a relic of a pre-Christian custom. Saint Valentine's Day being selected since the saint's name corresponded closely with the old French word *Galantin*, a gallant.

VALENTINIAN. The name of three Roman emperors of the West, only two of whom are of importance historically.

Valentinian I (321-375) was of humble birth, but won distinction in the army, and on the death of Jovian, in 364, was chosen emperor. He divided the empire into two parts, surrendering the East to his brother Valens (see VALENS) and keeping for himself Italy, Spain, Gaul, Britain, and Africa. Throughout the reign of Valentinian, the German tribes to the north (the Alemanni) were very active, ravaging the frontiers, while in Africa risings among the desert tribes were frequent. Valentinian died of apoplexy during a campaign against the Quadi.

Valentinian III (419-455) was a grandson of the Emperor Constantius, by whom he was raised to the imperial rank in 425. His mother, Placidia, governed for him during his minority; after her death, he proved a weak and purposeless ruler. Although Valentinian's general, Aëtius, won a great victory over the Huns under Attila and defeated the Visigoths in Southern Gaul, the empire

had grown too feeble for effective resistance, and was gradually dismembered. Africa was lost to the Vandals, Britain to the Scots and Picts, and much of Spain and Gaul to the Visigoths and Suevi. Valentinian met his death at the hands of the adherents of Aëtius, whom he had himself murdered.

VALERA, *vá le' rá*, EAMON DE. See DE VALERA.

VALERIAN, *ta le' rian*. (PUBLIUS LICINIUS VALERIANUS; (about 190-260). Emperor of Rome from 253 to 260. On the death of Gallus, Valerian was declared emperor by the army, but though a man of ability and honesty, he was too old and enfeebled to rule at such a troubled time, for the Goths and the Germans were threatening the Western provinces and the Persians had taken Armenia. Entrusting the European wars to his son, Valerian went to the East, where, after some temporary successes, he was defeated and taken prisoner.

VALERIAN. A common wayside plant bearing globular clusters (corymbs) of small rosy flowers on 3-ft. stems in summer; the leaves are pinnate. Related to it are dwarf-scented kinds often grown in rock gardens.

VALHALLA, *val' hal' á* (Hall of the Slain). In Northern mythology, the most magnificent palace of Asgard, where Odin feasted with his heroes.

VALKYRS, *val' kirs*, OR **VALKYRIES**, *val' kí' rí:z*. In Norse mythology, warlike divine maidens mounted on horses and armed with helmets, shields, and spears, who were sent by Odin to every battlefield to determine the result and choose the bravest of military heroes and carry them to Valhalla.

VALLEY. An elongated depression between mountains, hills, or bluffs. The sides of the valley are known as the *slopes*, and the bottom is called the *floor*. Valleys are formed by folding of the earth's crust or by erosion. Those formed by folding are usually between mountain ranges, and for this reason are designated by geographers as *intermontane* valleys.

Valleys running parallel with the mountain ranges are called *longitudinal* valleys, those running across the ranges are *transverse* valleys.

Valleys formed by erosion are usually narrow and steep in the upper part of the river's course, and broad, with more gentle slopes, in the lower part of the course. Here the floor of the valley may be broad and level, affording large areas of fertile soil.

VALOIS, *val' wá'*, HOUSE OF. A branch of the great Capetian family that ruled in France from 1328 to 1589. On the death of Charles IV in 1328, without male heirs, his cousin, the grandson of Philip III, came to

the throne as Philip VI. Edward III of England, a grandson of Philip IV, also laid claim to the French crown, and the result was the disastrous conflict known as the Hundred Years War (which see). Philip's successors in the direct line were the following: John (1350-1364), Charles V (1364-1380), Charles VI (1380-1422), Charles VII (1422-1461), Louis XI (1461-1483), Charles VIII (1483-1498).

On the death of Charles VIII without male heirs, the succession passed to Louis, Duke of Orleans, great-grandson of Charles V, who became Louis XII and founded the House of Valois-Orleans (see ORLEANS). He died in 1515, leaving no son, and Francis of Angoulême came to the throne as Francis I, the first of the Angoulême branch. His successors were Henry II (1547-1559), Francis II (1559-1560), Charles IX (1560-1574), and Henry III (1574-1589). At Henry III's death, the Bourbon family, in the person of Henry IV (Henry of Navarre), came to the throne.

VALPARAISO, *val pah rah e' so* (Vale of Paradise). The capital of the province of Aconcagua, and second largest city of Chile, with a population of 193,000.

It has electrified rail communication with Santiago, for which city it is the port, and is connected with Buenos Aires by the transcontinental railroad and the Andean tunnel, opened in 1910. It is a manufacturing centre of considerable importance, the chief products including cotton goods, machinery, tobacco goods, refined sugar, and liquor.

VALUE. In economics, the power of one thing to purchase other things at a particular time and place. Thus value expresses the relation between two things. Value must not be confused with price. By price is meant exchange value in terms of money, whereas the term value, in its economic sense, means exchange power in terms of other commodities. Adam Smith pointed out that value could mean either *value in use* or *value in exchange*. The value of a thing as distinct from its price, however, is its general purchasing power, and, so Nicholson argued, the conception of general purchasing power is unworkable unless we introduce the idea of price. Prices, to some extent, must be related to value, and the common method of measuring the value of any commodity, i.e. its general purchasing power, is by an index of prices.

The process by which the value of a commodity is determined is often described as the law of supply and demand, but in the examination of this law it is almost impossible to differentiate between exchange value and the market price. A temporary

equilibrium price is obtained when the quantity demanded equals the quantity supplied, and when free competition has been allowed to operate. Frequently such competition is absent, and a seller is able to give a commodity an artificial, or monopoly, value; on the other hand, if there is a shortage of commodities from some calamity such as fire, drought, etc., then the commodity is said to have a scarcity value. See **ECONOMICS**.

VALVE. A term applied to various mechanical devices to control the flow of fluids in pipes or vessels. In physiology, the word is applied to similar natural formations, such as the heart valves. There are several forms of valves, including (1) *automatic* valves, which are opened and closed by the pressure and back-pressure of the fluid, as those in the hydraulic press, the pump, and the heart; (2) *non-automatic*, which are operated by hand or some outside force, as the valves of musical instruments; (3) *sliding*, like those of a steam-engine cylinder.

VAMPIRE. In Russian and other superstition, a ghost which comes from the grave at night to suck the blood of living people, especially of young persons. The sleeping victim is not aware of what is happening, but gradually wastes away and dies.

A wizard, a witch, a suicide, and one cursed by Church or parents, were all supposed to become vampires at death. The only way to prevent the crimes of a vampire, it was believed, was to dig up the corpse, burn the head and heart, and bury the body with a stake through it.

VAMPIRE BAT. The name applied to various bats, but especially to two species of blood-sucking bats found in Central America and tropical South America, which attack men, fowls, and other warm-blooded animals. Although few of the vampire bats indulge in this practice, the two mentioned are real blood-suckers. The common vampire bat is a small, reddish-brown animal, about 3 in. long, with large, spreading ears, a sharp tip on the nose, and keen, triangular front teeth, which inflict small deep wounds. Its food canal is too narrow for the passage of anything but blood. See also **BAT**.

Scientific Name. True vampire bats belong to the family *Phyllostomatidae*. The common species is *Desmodus refus*.

VANADIUM, *va nay' dium*. A rare chemical element which, in its pure metallic form, resembles silver in appearance. It never occurs free in nature, but exists in small quantities in certain ores of copper, lead, and iron.

As a metal, vanadium is of no practical value, but a number of its compounds are used in the arts. A compound of vanadium

and ammonium is used in the manufacture of black aniline dye and in making vanadium ink. An acid which exists in the form of a bright-yellow powder is used as a substitute for gold bronze, and some of its compounds are used sparingly in medicine. Metallic vanadium is often added to steel, to which it gives unusual strength and elasticity.

Peru is an important source of the metal, and vanadium ores are also found abundantly in South-east Africa, Northern Rhodesia, and the United States. In Europe, the metal is obtained from ores found in Cheshire, England, and in Germany and Sweden. The symbol of vanadium is *V*.

VANBRUGH, *van' brô*, SIR JOHN (1664-1726). An English architect and dramatist, born in London. A keen wit, he also acquired a reputation for immorality. Vanbrugh's first play, *The Relapse*, was successfully produced at Drury Lane Theatre in 1690, and a few months later *The Provok'd Wife*, presented at Lincoln's Inn Fields Theatre, proved even more popular. As an architect he won equal distinction. He was appointed comptroller for the Board of Works in 1702. Castle Howard, designed for the Earl of Carlisle, and completed in 1714, is his best work.

VAN BUREN, MARTIN (1782-1862) An American statesman, the eighth President of the United States. The son of a small farmer, he was successively office boy, lawyer's clerk and a copyist of pleas. He became dominant in the political life of New York, and in 1812 was elected to the State Senate. In 1815 he became Attorney-General of New York, and distinguished himself on the judiciary and finance committees of the Senate. Governor of New York in 1827, Secretary of State in 1829, he was elected



VAN BUREN
Photo: Brown Bros.

Vice-President in 1832. His Presidency covered the years 1836-1840, a period of great social disturbance in the States. Retiring into private life at the close of his term, he soon re-entered politics and wielded much influence for nearly twenty years.

VANCOUVER, *van ku' ver*. BRITISH COLUMBIA. The metropolis of Western Canada and the third largest city in the Dominion; also its chief seaport and the regular port of call for fifty-three steamship lines, which

operate not only between the chief ports of the Orient, but also between important seaports in Europe, Australia, New Zealand, and the United States. The population of Vancouver proper was 246,593 in 1931; Greater Vancouver, which includes Burnaby and North and West Vancouver, has a population of about 308,000.

Vancouver was incorporated in April, 1886, and two months later was completely destroyed by fire. The city is situated in a beautiful setting of sea and mountains, and its mild climate offers an inducement to many people from eastern parts of the continent.

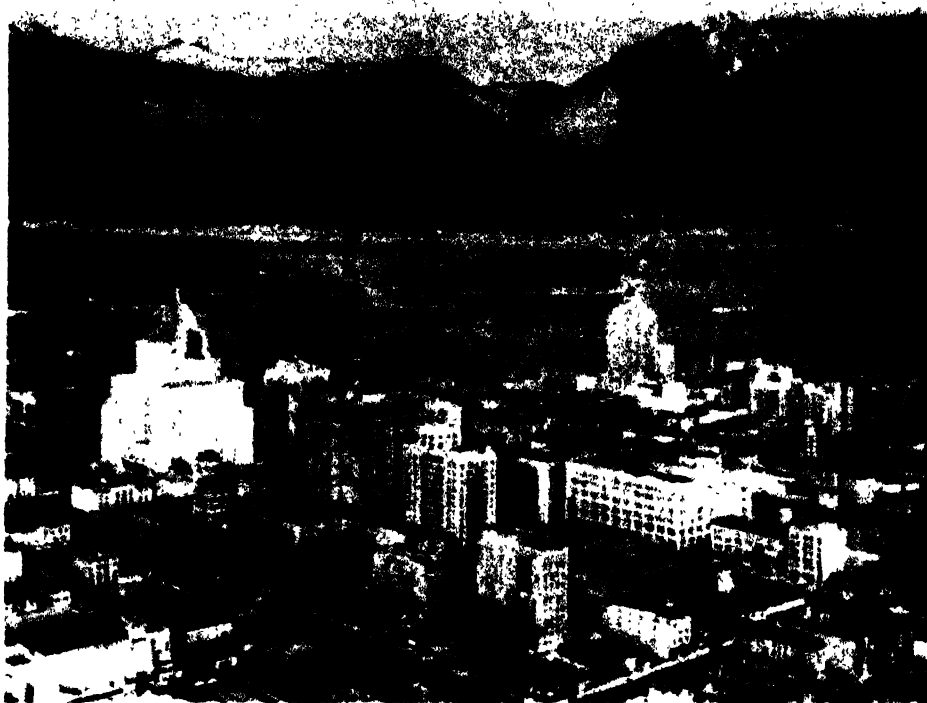
It is a wholesale and manufacturing centre, notably for canned and salt fish, timber, wood tiles, and other products, timber ships, structural steel, furniture, and machinery of various kinds. Timber, wheat, flour, and apples are the chief exports. A large part of the British Columbia fisheries are centred near Vancouver.

VANCOUVER ISLAND. The largest island on the west coast of North America with a population in 1931 of 121,000 and an area of 12,468 sq. miles.

The mountain slopes are covered with magnificent forests of fir, cedar, and spruce trees. The coalfields of the island supply a large part of the fuel used in British Columbia. Large iron deposits exist, but have not as yet been developed. Rich agricultural areas have been cultivated in the valleys. The lakes and streams abound in fish, and there is an abundance of big game. Victoria (population 60,000), at its southern end, is the capital of the province of British Columbia.

VANDALS. A Germanic people who, in the early part of the Christian Era, occupied north-east Germany, between the Oder and the Vistula rivers. They spread into Silesia and Pannonia during a succession of wars, and in 406 moved westward but failed to secure a footing in Gaul. Under their king, Gunderic, they crossed the Pyrenees in 409 and entered Spain, fighting the Suevi and the Goths and Romans. Under Genseric, they invaded Africa in 429. Carthage became the Vandal stronghold, and the Christians were mercilessly persecuted.

For fifty years, Genseric was a scourge to Constantinople and Rome. In 455 he sacked Rome, and his soldiers plundered the temples of works of art, and emptied the city of its wealth. After Genseric's death, in 477, Hunneric, his son, kept the people along the Mediterranean in terror. To-day those who wantonly engage in devastation of this sort are called *vandals*. The Vandal kingdom was overthrown in 534 by Belisarius, a general of the Emperor Justinian, who captured Carthage.



PART OF THE BUSINESS SECTION AND HARBOUR OF VANCOUVER

Photo. Canadian Airways, Ltd.

VAN DIEMEN, ANTHONY (*d* 1645). Governor of the Dutch East Indies during the principal period of the development of Dutch interests in the tropics, he was born at Knulenberg in Holland. He started his career in India as an accountant and ultimately became Governor-General. In 1642 he commissioned a Dutch commander, Abel Tasman, to explore the coast-line of S.E. Australia, to which the name Van Diemen's Land was given. In 1798 the region was first circumnavigated and its island character revealed. The name was changed to Tasmania when it was given self-government in 1856.

VAN DYCK OR VANDYKE, SIR ANTHONY (1599-1641). A celebrated painter of the Flemish School who later made his home in England, he studied under Hendrick Van Balen, and early distinguished himself by his skill as a portraitist. When he was twenty he entered Rubens' studio, and here he worked as an apprentice for a short time. Afterwards, in 1620, following the example of Rubens, he visited London, and then made a five years' tour of Italy, staying at Genoa, Venice, and Rome, painting during this period many of his finest works. He

returned to Antwerp in 1628, where he painted the "Ecstasy of St. Augustine" for the Chapel of the Augustine Monastery and also a number of commissioned portraits. In 1632, Charles I summoned him to England where he became court painter, and where he lived for the rest of his life, with the exception of one short visit to the Netherlands in 1634.

Van Dyck had all the grace and elegance required of a court painter, and his quiet and dignified portraits have earned him a well-merited reputation. Towards the end of his life, when commissions began to crowd on him, however, he made the same error as his master, Rubens, in permitting the greater part of his work to be done by apprentices.



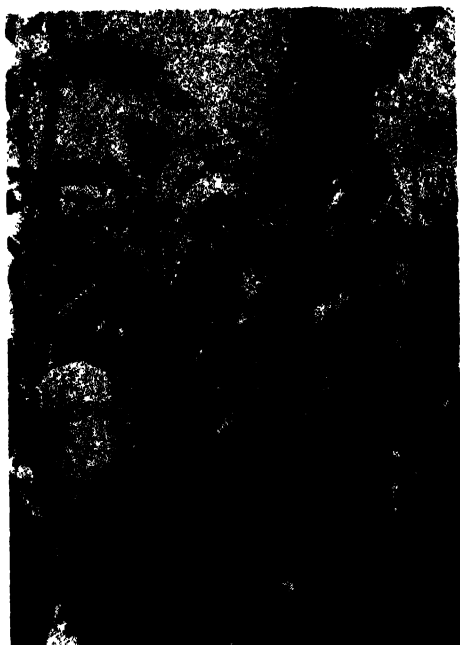
VAN DYCK

Photo: Brown Bros.

Van Dyck's work may be studied in most public galleries in England, and among those at the National Gallery may be mentioned the full-length portrait of Lady Rich and the two exquisite portraits of Cornelius van der Geest and La Marchesa Cattaneo.

VAN GOGH. See GOGH, VINCENT VAN.

VANILLA. A genus of climbing orchids, of commercial value as the source of an extract widely used in flavouring confectionery, and perfumes. The species pro-



VANILLA PLANT IN MEXICO
Photo: Visual Education Service

ducing most of the vanilla of commerce is native to the countries of North and South America between Mexico and Peru. Its culture has been extended to France, Java, Ceylon, the West Indies, and other warm regions. The plant has a long stem and aerial rootlets, and is enabled to attach itself to trees by the latter. The roots also penetrate the soil. It lives for nearly half a century, and produces its first crop at the end of three years.

The fruit is a cylindrical pod, or "bean," from 6 in. to 10 in. long, with an oily black pulp containing large numbers of tiny black seeds. The pods are gathered before they are ripe, are slowly dried, and then sweated, or fermented, the latter process serving to develop the flavour and aroma. The com-

mercial extract is prepared from the pulp of the beans.

Scientific Name. The vanilla plants are members of the family *Orchidaceae*. The species described is *Vanilla planifolia*.

VAPOUR. In physics, a term applied to the gaseous state into which solids and liquids pass when heated. In a technical sense, both steam and oxygen are vapours. It is customary, however, to make this distinction between gases and vapours: the former retain the form of air at ordinary temperatures, and the latter resume their liquid or solid state under the same conditions. The process of converting a substance from solid or liquid form into a vapour is called *vaporization*. *Evaporation* and *boiling* are forms of vaporization; in the one case, the change to a vaporous condition takes place slowly and quietly, and in the other very rapidly. When the boiling point of a solid is lower than the melting point, and it vaporizes and again condenses, apparently without first becoming a liquid, it is said to undergo *sublimation*.

VARIATIONS. In music, the repetition of a given theme or tune in such a way that a sense of variety is introduced, i.e. certain musical devices are used to disguise the repetition. These devices are of several kinds. Sometimes grace notes are introduced, sometimes runs are introduced into the bass. The art of variation is important to the perfection of the sonata form of composition.

VARICOSE, var' ri kēs, VEINS. Veins that have become dilated through some condition which interferes with the flow of venous blood back to the heart. Veins in the legs are commonly affected, especially in cases where much standing is necessitated. Other predisposing causes are diseases of the heart and liver, gout, and child-bearing. In advanced cases, knotty lumps of a bluish colour form along the vein, and the victim experiences considerable pain in the affected limb. The chief danger arises from the bursting of the vein, with resulting hæmorrhage. Relief is obtained by giving external support to the vein by bandages, or they may be cured by the injection of sclerosing fluids.

VARNA. See BULGARIA.

VARNISH. A clear, liquid preparation which dries to a hard film when exposed to the air. It is used to preserve various surfaces from the influence of the air and moisture, and to beautify them. It consists of a solution of resinous gums in alcohol, turpentine, or linseed oil, and imparts a thin, transparent gloss to wood, metals, paint, paper, leather, and other substances.

The resinous bases most commonly used are copal, lac, mastic, sandarac, amber, and

asphalt. The principal colouring-matters employed are rattan-palm resin, saffron, gamboge, cochineal, turmeric, and coal-tar dyes.

Varnishes are divided into three classes, according to the solvents used. Those in which the gums are dissolved in alcohol are called *spirit varnishes*. They consist chiefly of a solution of soft, non-fossil resins, as shellac, sandarac, mastic, etc., and are made in revolving churns. They dry rapidly, leaving a very hard and brilliant coat, which cracks and also scales if exposed to the weather, and are used chiefly for cabinet work, gilding, and metal work.

Turpentine varnishes are brighter and less brittle. The principal solvent is turpentine, though linseed oil is frequently added to increase the tenacity. These varnishes are used for oil paintings. In *oil varnishes*, the solvents are linseed, poppy, or walnut oil, and the basis is a hard fossil gum, such as copal, a gum found in Zanzibar, New Zealand, Sierra Leone, and the Philippine Islands.

The transparent varnish known as *japan* is a solution of pure asphaltum with a gum, dissolved in linseed oil and thinned with turpentine. Japanning (which see) is done in black or body-colours. The brilliant black effect is secured only by repeated coatings. In China and Japan, the natural varnishes used in lacquer work are made from the liquid sap of the lacquer, or varnish tree.

VARRO, MARCUS TERENTIUS (116-27 B.C.). A prolific Roman writer born in the Sabine village of Reate. He was employed by the state in the wars against the pirates and Mithridates, and was attached to the party of the Senate, sharing in the Battle of Pharsalia (48 B.C.). He received imperial favour under Caesar and Augustus, although proscribed for a time by the second triumvirate.

Varro is said to have written 620 books. His prose writings, surviving only in fragments, covered oratory, history, literature, philosophy, grammar, jurisprudence, geography, and agriculture. His work was highly praised by contemporary critics such as Cicero.

VASA, HOUSE OF. The royal family of Sweden. See GUSTAVUS; SWEDEN.

VASCO DA GAMA, *vas' ko da gah' ma*. See GAMA, VASCO DA.

VASCULAR SYSTEM. The system which includes the circulation of all the fluids of the body, including the blood, the lymph, and chyle. It is made up of the heart, the arteries, veins, and capillaries, and the lymphatics. The heart provides the energy for this circulation, and the blood-vessels are the channels which carry the blood to and from the tissues.

VASELINE, *vas' e lin*, or *vas' e leen*. A soft, amber-coloured or colourless grease, prepared from the residue of the distillation of petroleum, and in an unadulterated state almost odourless and tasteless.

VASO-DILATOR NERVES. Those nerves which, when stimulated, cause blushing (which see).

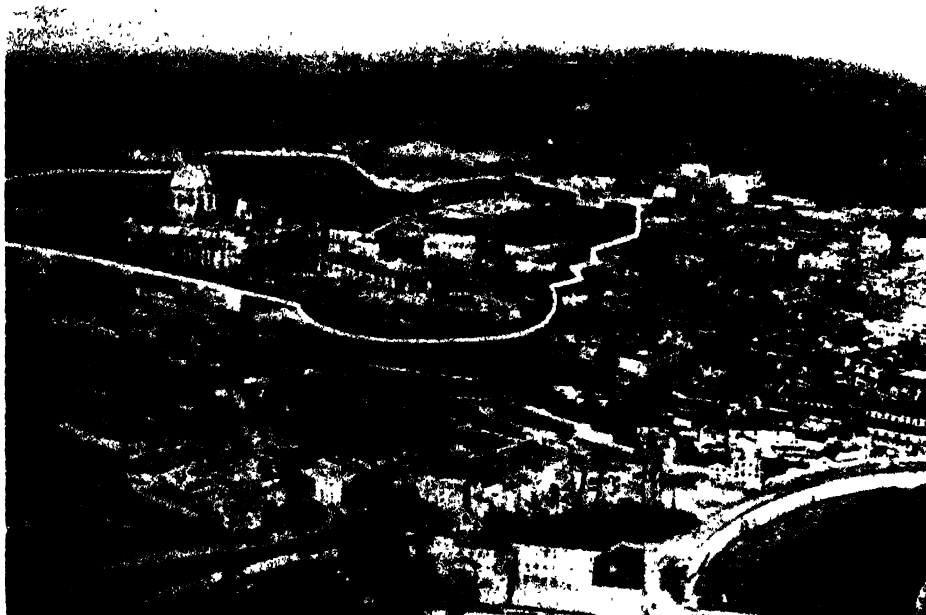
VASSAL. See FEUDAL SYSTEM.

VATICAN. The palace in Rome which contains the residence of the Pope and, in addition, the Papal gardens, a valuable library, an extensive art collection, and museums of various kinds. The name is derived from *Vaticanus Mons*, the Vatican Hill of ancient Rome. It has been the official Papal residence since the return from Avignon in the fourteenth century. Until 1929 (see VATICAN CITY) the Popes had not travelled beyond the limits of its gardens since 1871. The Vatican is protected by the Papal or Swiss Guard, many of whom to-day are students; the uniform was designed by Velazquez. These should be distinguished from the Noble Guard, a mounted bodyguard with more limited service, recruited from members of noble families.

VATICAN CITY. A state created in 1929 by a political treaty made between the Holy See and the Italian government, which restored to the Papacy the recognition of temporal rights lost in 1871 (see PAPAL STATES). By this agreement, the Pope was given civil power over a tiny state consisting of 108.7 acres, arround and including the Papal buildings in Rome. In this state, which is entirely independent of the Italian government, are not more than 1025 people. All of the public works, including the postal and telegraph systems, water supplies, and lighting and street-cleaning service, were turned over to the new state, and it has its own flag, coinage, stamps, and railway station.

The Vatican City receives income and revenues from contributions from faithful Catholics, and whatever local taxes the new state may impose. In addition, the treaty which established the new state granted it an indemnity, partly in cash and partly in negotiable Italian state bonds, for the loss sustained by the Holy See since 1871, when the Papal territory was placed under the political control of the Italian government.

VATICAN COUNCIL. A general council of the Roman Catholic Church, called by Pope Pius IX in 1868. This council reaffirmed the fundamental doctrines of the Church, and also proclaimed and ratified the doctrine that the Pope, when speaking in virtue of his office to the whole church (*ex cathedra*) on matters of faith or morals, is infallible.



VATICAN CITY

The photograph, taken from the air, shows part of the city of Rome, and in the background a line has been drawn round the boundary of the Vatican City. St. Peter's is conspicuous and beside it are the Vatican Palace and Gardens

Photo P. & A

VAUDEVILLE, *vōd' vil*. A term now generally applied to a performance of music, singing, dancing, or entertainment of any other kind, given in a series of short "acts." The term first originated in France, and was applied to drinking songs, humorous and satirical, that were composed by a man living in Vire in the Vaux de Vire, two valleys of Normandy. It was introduced into stage performances as an adjunct to the drama.

VAUGHAN WILLIAMS, RALPH (born 1872). British musical composer. Born at Down Ampney in Gloucestershire, he studied at Trinity College, Cambridge, and the Royal College of Music. He became interested in the revival of English folk music, but his creative work was interrupted by the World War, since which his best work has been accomplished.

VAULT, *vawlt*. In architecture, a roof or ceiling in the form of an arch. There are four principal varieties: the *barrel* vault, the *dome*, the *groin* vault, and the *ribbed* (Gothic) vault. The simplest form is the barrel vault (see 1 in illustration). It is a continuous arch, so built that all parts are held in place by parts immediately adjacent. The dome developed from the barrel vault, and was at first a hemisphere built upon a circular base.

The groin vault is formed by the intersection of two or more barrel vaults, as shown in 2 of the illustration. The lines of intersection (a) are called *groins*. In ribbed vaulting, arched ribs are built in the places that otherwise would be occupied by groins. The ribs rest on pillars and make massive walls un-



BARREL AND GROIN VAULTS

Explanation appears in the text.

necessary. In Gothic architecture, such ribs were employed both for structural and for decorative purposes. See ARCHITECTURE.

VAVASOUR. A term used sometimes to denote a sub-vassal, sometimes as a synonym for vassal.

VEDAS, *vay' dās*. A term derived from a Sanskrit word meaning *to know*, and used to designate the oldest sacred writings of India.

These works are written in Sanskrit and are supposed to have been produced between 1500 and 1000 B.C. A succession of authors, generation after generation, added to them, so that they represent the progressive religious thought of centuries, the earliest being by far the simplest. The Vedas are divided into four parts, *Rig-Veda*, *Yajur-Veda*, *Sama-Veda*, and *Atharva-Veda*, of which the *Rig-Veda* is the oldest and most important, as well as the stateliest in form.

VEGA. See ASTRONOMY (the Stars and their Names).

VEGA CARPIO. *vay' ga kar' pyo*, LOPE FELIX DE (1562-1635), commonly called LOPE DE VEGA. A Spanish dramatist and poet, founder of the Spanish theatre, born and educated at Madrid. His career as a dramatist began when he was still a student.

In all he wrote about eighteen hundred comedies, four hundred short religious pieces for the stage, a number of interludes or brief dialogues, several prose romances, a great number of lyrics, and three epics.

Carpio's influence on contemporary literature was immense. He was honoured in his own day and in spite of a dissolute life was created a knight of Malta by Pope Urban VIII. In 1614, overcome by remorse, he became a priest and passed the rest of his life in seclusion. Among his best plays are *Punishment without Vengeance*, *The Star of Seville*, *The Sword of Madrid*, *The Captives of Argel*, and *Strife unto Death*.

VEGETABLE. In the usual sense, the word *vegetable* is applied to those plants whose leaves, stalks, roots, or tubers are used for food, such as lettuce, asparagus, cabbage, beets, and turnips. It also includes several plants whose fruits are the edible portions, as peas, beans, melons, and tomatoes.

Most of the vegetables contain a large proportion of water, ranging from ninety-five parts in the cucumber to eight and one-half parts in dried lentils, and nine parts in dried peas. With the exception of beans, lentils, and peas, vegetables contain less nutriment than animal foods. As a rule, however, they are less difficult to digest and are rich in carbohydrates. Moreover, they are valuable for their mineral content, vitamins, and cellulose, or woody portions. Green vegetables are especially valuable as sources of vitamins (which see). Beans, peas, and lentils are rich in protein and are among the most nutritious foods.

VEGETARIANISM. *vej e lair' ian iz'm*. The theory and practice of living upon a vegetable diet, excluding fish, flesh, and fowl. The term came into use about the year 1847, but the doctrine is centuries old, having been advocated by Pythagoras, Plato, and Plutarch.

There are various schools within the general vegetarian group. For instance, some would exclude not only meat of every kind, but such animal products as milk, eggs, and cheese. The majority of vegetarians, however, simply reject the use of flesh, fowl, and fish.

Basis for Belief in a Vegetable Diet. The chief arguments on which the vegetarians base their practice are as follows—

The avoidance of such diseases as may be communicated from unhealthy animals to man; the saving of cost, for meat is far more expensive than its equivalent in vegetarian foods; economy of land, for a given area will sustain a greater food value in crops than in herds; the avoidance of the cruelty that, it is claimed, is inseparable from the slaughter-house; the better satisfaction of the physiological nature of man. Opinion at the present time appears to favour a mixed diet, but the tendency is to reduce the amount of meat eaten. See VEGETABLE; FOOD.

VEIN. A mass of mineral matter filling a crack or fissure in rock. Water carrying minerals in solution has often deposited some of its dissolved material on the walls of a crevice through which it was percolating, thus forming a *vein*. Vein material may be deposited from ground water descending through the rock, or from heated water ascending from some depth, or from vapour given off from some intrusive rock in the vicinity. Veins range in thickness from a mere film to many feet, and in length from a few inches to several miles.

Many veins contain the ores of one or more metals, and most of the mines from which some metallic ores are obtained are opened along such veins.

VEINS. In anatomy, a system of tubes or blood-vessels through which the blood is carried from the capillaries to the heart.

The veins begin at the capillaries. They are minute at first, but as they proceed from the capillaries, they join larger veins, until eventually all of the venous blood in the body is poured into two very large veins which open into the heart. One of these, the *superior vena cava*, carries blood from the head and arms to the heart; the other, the *inferior vena cava*, conducts it from the trunk and lower limbs. The veins, like the arteries, have walls composed of three coats, but those of the veins are thinner and less elastic than those of the arteries. The blood current flows through the veins more slowly than through the arteries and without pulsation. A distinguishing feature of most veins is their possession of many valves, formed by pouches in their inner coat. When the current is flowing onward, they lie

against the walls, but if the flow is obstructed, the valves automatically close and bar the backward passage of the fluid.

VELAZQUEZ, *vè lah's' kay*, DIEGO RODRIGUEZ DE SILVA Y (1599-1660). Acknowledged to be the greatest of Spanish painters, Velazquez was born in Seville, the son of Rodriguez de Silva, a lawyer, but in accordance with a Spanish custom he adopted his mother's name. In youth he studied under the elder Herrera and later under Pacheco, whose daughter he married in 1618. Four years later he went to Madrid where he met



VELAZQUEZ
Photo: Brown Bros.

with rapid success, and became court painter in 1624 under the patronage of Philip IV, who remained his friend and benefactor for the rest of his life. Velazquez painted a long series of masterpieces, the majority, including most of his finest works, remaining to-day at the Prado in Madrid.

In 1628, Rubens arrived in Madrid on a diplomatic mission and, perhaps as a result of his advice, Velazquez with Royal consent visited Italy in the following year, sailing from Barcelona in the company of the Marquis of Spinola, whose victory at Breda was later to be the subject of one of his most famous pictures. He returned to Madrid in 1631 to continue those portraits which have familiarized us with Philip IV and his court. About 1647 he founded an Academy of Art in Spain and in 1649 commenced a second tour of Italy commissioned to purchase sculpture. It was during this visit that he painted the celebrated portrait of Innocent X, now in the Doria Palace in Rome. In 1659 he received from Philip IV the highest honour which could be conferred on a nobleman: the Red Cross of Santiago.

Among other famous pictures of Velazquez may be mentioned "Las Meninas," painted in 1656, and the "Rokeby Venus" now in the National Gallery, London. "Portrait of the Infanta Margherita," "Marie Anne," and "Portrait of a Girl" are among many examples in the Louvre.

VELD, *felt, or vell*. The Dutch word for plain. See UNION OF SOUTH AFRICA.

VELLUM. See PARCHMENT.

VELOCITY. A term used in physics to express the rate at which bodies change position in space. Kinetic energy (that is,

energy due to motion in actual operation) is the product of half the mass and the square of the velocity. The simple product of mass and velocity is the momentum. Velocity is expressed as so many miles per hour, so many feet per second, etc. It is said to be *uniform* when the spaces traversed in given units of time are equal, and *variable* when these spaces are unequal. An increase in velocity is an acceleration, and a decrease is a retardation. A body falling under gravity undergoes acceleration, whereas a body thrown upward is retarded.

VELVET. A pile fabric woven of silk or silk and cotton. On one side is a close, fine, and soft pile, and on the other is a strong, close tissue without pile. The pile is formed by part of the threads of the warp, which are put over wires on the surface; a knife is passed along a groove in each of the wires, cutting the loops when it is withdrawn. A velvet in which silk is used for both back and pile is called *silk velvet*; one with silk pile but a cotton back is *cotton-backed velvet*; one having cotton for both back and pile is *velveteen*. In the velveteen fabric the pile is produced by cutting the weft yarns, whereas in the velvet cloth the warp yarns are cut to form the pile. The term *plush* is applied to fabric of this kind whose pile is over $\frac{1}{4}$ in. long.

The modern centre of the velvet industry is at Lyons, France, which displaced Florence and Genoa, famous for velvet manufacture in the Middle Ages.

VENDETTA. The Italian name for a form of private warfare, until recently associated particularly with Corsica. The feuds from which these vendettas arose were due to the belief that when a person is slain, his nearest kinsmen become responsible for the avenging of his death; if the guilty person escapes, punishment is meted out to his nearest relatives. Feuds are sometimes handed down from one generation to another.

VENEER, *ven eer'*. A thin sheet of wood, pearl, ivory, or other material, glued on the surface of various woods to give a more artistic finish. Mahogany, walnut, rosewood, and maple are all popular veneers. The veneer may be nearly as thin as paper. Furniture veneers average one-sixteenth of an inch in thickness. After gluing, the wood is pressed, the superfluous glue is wiped off, and the surface is polished.

VENEREAL DISEASES, from the Latin Venus, goddess of Love. A group of contagious diseases contracted most commonly by sexual promiscuity. The two most important are *syphilis* and *gonorrhoea*; there are also *soft chancre* and certain minor ailments in this group. Formerly syphilis was responsible for a terrible amount of suffering from ulcers, skin diseases, diseases of the

nervous system, insanity, and other disorders; gonorrhoea gave rise to sterility in either sex, strictures in the male, abscesses and other infective lesions, and in the case of infants contaminated at birth, blindness. Modern treatment has mitigated these evils to a great extent (see SALVARSAN), and much has been done by the education of the public about the nature of these diseases and the importance of prompt and thorough treatment.

VENESECTION. A term derived from two Latin words meaning *vein* and *to cut*, denoting the practice, less frequently used now than formerly, of making an incision into a vein for the purpose of extracting blood. Other names by which venesection was known are *blood-letting* and *phlebotomy*.

VENEZUELA, *ven e zue' la*. Officially known as the UNITED STATES OF VENEZUELA, a republic of South America, lying on the southern coast of the Caribbean Sea, with an area of 352,051 sq. miles and a population in 1932 of 3,261,734 (estimated).

The People. The white people are very generally of Spanish descent, and constitute the ruling class, though they number only about 10 per cent of the population. There are many Indians, especially in the llanos, but the mestizos (of mixed white and Indian blood) constitute the greater part of the population. Since the days of the African slave trade, there has been considerable negro blood among them. The State religion is Roman Catholicism.

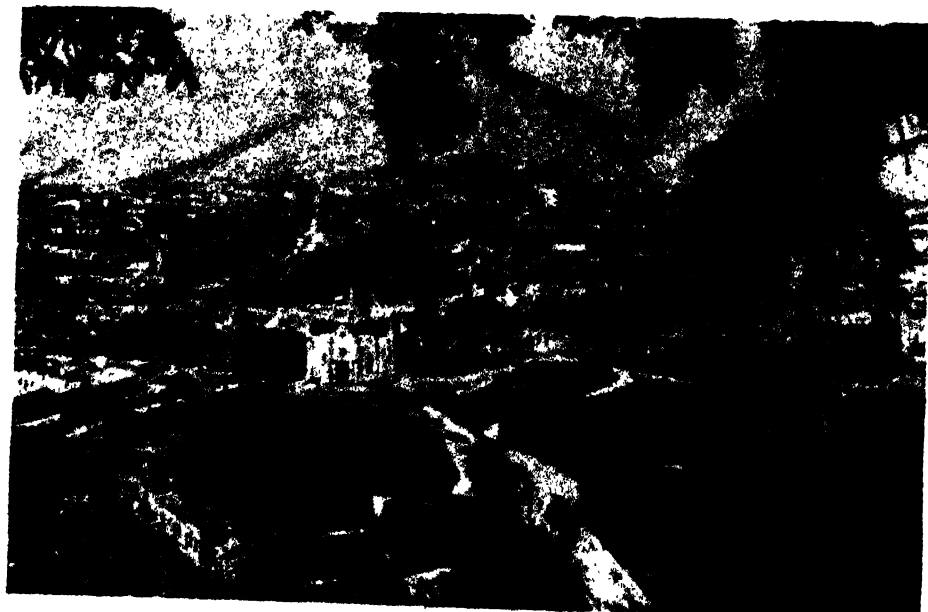
The most important cities are—

Caracas, *kā rah' kas*, the principal city and the capital of the country. Though it is only about 6 miles inland from the Caribbean and La Guaira, its port, the railway and highway which connect Caracas with the sea must follow a winding route of 22 miles along a steep incline. The city lies about 3000 ft. above the level of the sea.

Caracas was founded in 1567. It was almost destroyed by earthquake in 1812. Despite this disaster it is to-day an attractive well-built city. The city was the birthplace of Simon Bolivar, the greatest of South American heroes. Population, about 150,250.

Maracaibo, *mah rā ki' bo*, the principal seaport, lies on a strait that furnishes an outlet for Lake Maracaibo to the Gulf of Maracaibo, and thence to the Caribbean Sea. It is thus important as the only port of entry for Western Venezuela and a section of Eastern Colombia; and as the centre of the agricultural district, it carries on a trade in petroleum, coffee, cocoa, hides, sugar, dye woods, and quinine. The recent development of the petroleum industry in the Lake Maracaibo region has brought in a large foreign population engaged in the export and refining of the crude oil. Population, about 74,000.

Physical Features and Climate. Venezuela is divided into four regions, known as the llanos, the plateaux, the mountain districts, and the coastal plain. The llanos are the



THE CITY OF CARACAS, THE CAPITAL OF VENEZUELA
Photo U. & U.

river valleys and low, wet plains, suited to the pasturing of great herds of cattle; this region stretches from east to west across the country and south along the Orinoco River. The plateaux and highlands of the south-east and the llanos comprise nearly 80 per cent of the country, but are very sparsely settled. The plateaux, known as the Guiana Highlands, are covered with forests and inhabited largely by uncivilized Indians.

The eastern spurs of the Andes are in the north-western and northern parts, and it is in this region that most of the people live. In the north-west occurs the loftiest altitude in Venezuela, the Sierra Nevada de Mérida, which reaches a height of 15,400 ft.

The Orinoco is the great river of Venezuela, flowing for most of its 1500 miles through forests that are scarcely explored. It has hundreds of tributaries, among which is the Cassiquiare, which also connects with the Rio Negro, a



VENEZUELA

A street in La Guaira showing a bridge over a public sewer
Photo: U. & U.

branch of the Amazon. Facing the delta of the Orinoco is the island of Trinidad, which belongs to Great Britain. Among the small islands off the northern coast belonging to Venezuela, Margarita is the only one of importance. The region of Lake Maracaibo is the chief agricultural district of the country.

The climate varies from the tropical heat of the coastal and river regions to the temperate climate in the residential districts of the north-west, and to the cold of the mountain tops. Caracas, over 3000 ft. above sea level, has an average annual temperature of 70° F., while its port, La Guaira, only 6 miles distant, and, Maracaibo, both cities on the sea, have an average temperature of 81° F. Rainfall is moderate and there is a considerable dry season.

Products and Commerce. The llanos afford grazing for cattle, raised chiefly for hides, though the meat cattle industry is growing. Goats and pigs are important. Coffee is the principal product, and there are about 30,000 plantations, producing an average of 100 million pounds annually. Cocoa is also exported in large quantities. Sugar, maize, beans, and coconuts are grown.

The forests, which cover nearly one-half of the country's area, yield rubber, medicinal plant products, wild vanilla, and tonka beans. Manufacturing is growing in importance. There are cotton and textile plants, besides manufactures of cement, glass, sugar, beer, cigarettes, chocolate, shoes, drugs, etc. The country is rich in metals and minerals, including gold, copper, coal, iron, and salt, but mining has scarcely been begun in earnest.

Venezuela's greatest mineral resource is



STREET SCENE IN LA GUAIRA, VENEZUELA
Cows are milked in the street before waiting customers.

Photo: Keystone

petroleum. It was not until 1912, however, that drilling revealed even a hint of the vast supply; from 1929-1934 Venezuela was second only to the United States as an oil-producer. In 1935, when its production was 148,000,000 barrels, it was exceeded by Russia also.

Transport and Communication. Pack animals and river steamboats serve the cross-country traffic. The total length of roads fit for motors is 5000 miles. There are various short lines of railway running independently, altogether not more than 700 miles.

Government. Under the new Constitution, adopted in 1929, the national Congress consists of a Senate of forty and a Chamber of Deputies of eighty-five members. Election is for three years. The president is elected for seven years. The twenty states have autonomy.

History. Venezuela was the mainland of America which Columbus discovered 1st August, 1498, on his third voyage.

In 1731 Venezuela received a captain-general from Spain, and its subsequent history was one of order and general prosperity for a long period. After three centuries, in all, of Spanish rule, independence was finally secured, under the leadership of Simon Bolivar, in 1811. Spain refused to recognize the independence of the country until 1845. Slavery was abolished in 1854.

The history of the republic is marked by intermittent rebellions, political insurrections, and boundary disputes.

In 1899 Cipriano Castro headed a revolution against President Ignacio Andrade, and after two years was recognized as President by the Congress. He became insolent to the creditor nations of Europe in the matter of Venezuelan indebtedness, and in 1902 Great Britain and Germany severed diplomatic relations with the republic. A "peaceful blockade" of Venezuelan ports by these nations and by Italy resulted in another appeal to the United States; the matter in dispute was referred to The Hague tribunal.

From 1908, Juan Vicente Gomez continued as President until 1929, gaining more dictatorial powers as time went on, and becoming more arbitrary in his rulings, but putting an end to all internal strife.

The country maintained neutrality during the World War, and in 1920 joined the League of Nations.

VENICE, official name **VENEZIA**. An Italian city situated at the northern end of the Adriatic Sea. It is unique in its position and in the magnificence of its architecture. It is built on numerous islands in a lagoon between the mouths of the Piave and Po.

There are about 16,000 structures on pile foundations (this method of construction

being necessary owing to the unstable nature of the islands on which they are built) and these for the most part look down upon winding canals instead of streets. Long, flat-bottomed gondolas, painted black, and with ends curving picturesquely from the water, take the place of taxi or omnibus; motor launches now offer competition.

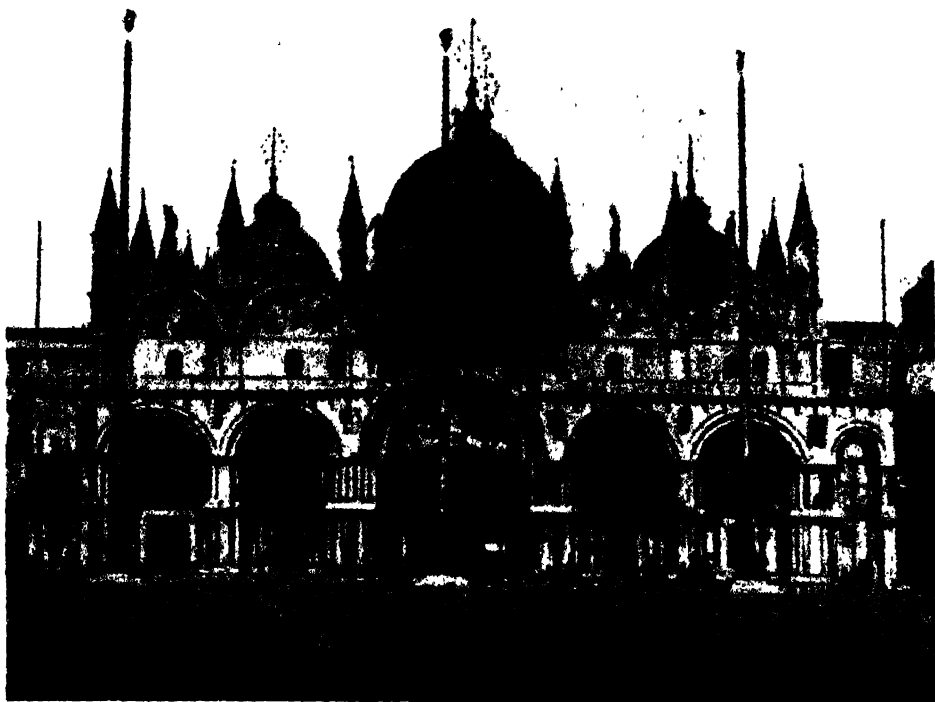
The islands fall into two main groups, separated by the famous Grand Canal. There are about 150 smaller canals, and also a number of paved streets and picturesque, crooked lanes. Four hundred bridges, including the "Rialto" and the "Bridge of Sighs," cross the waterways. The Venice Lido is a mudbank, similar to those on which the city is built, which has become a holiday resort.

The Piazza of St. Mark is one of the chief centres of interest. Its eastern side is occupied by St. Mark's Cathedral and the Doge's Palace, representative of Byzantine and Italian Gothic architecture respectively. The south side of the Piazza is occupied by the New Procuratie, and the opposite side by the Old Procuratie, two fine buildings representative of the Renaissance style. They were the residences of former officials known as *procurators*, and date respectively from 1584 and 1496.

Industries and Commerce. A period of decline followed the medieval era of commercial expansion, but within recent years, Venice has prospered greatly in many fields. The manufacture of torpedoes, the building of ships, the making of beads and glass and the production of laces, brocades, tapestries, jewellery, and other artistic wares are all flourishing industries. Plans for a new port for Venice on the mainland, which were interrupted by the Battle of Caporetto, in 1917, were continued under Mussolini in 1923. The tourist traffic also is increasingly important.

History. The city traces its origin to a group of huts built on the islands in the fifth century by a band of refugees fleeing from Attila's Huns. Gradually there developed out of a collection of villages a city state which, in the year 697, elected as its ruler an official bearing the title of *Doge*. By the middle of the fifteenth century, it was the head of a vast colonial empire and the most powerful maritime state of the Christian world. The discovery of a new water route to India by Vasco da Gama, and of the New World by Columbus opened up new trade channels and proved the death-blow to Venetian commercial supremacy.

In 1797 the Venetian republic was dissolved by Napoleon, and its possessions were transferred to Austria and France. In 1866 Venice was incorporated with Italy, and its



BASILICA OF ST. MARK, VENICE

history since that date has been a part of the history of the Italian kingdom. In 1935 the city's population was 273,539, a considerable increase over 1921, when it was 171,665. A notable feature of recent years has been the tendency to expand away from the canals. Road and railway link Venice with the mainland.

VENISON, *ven' z'n*. The flesh of the deer.

VENIZELOS, *ven e zay' los*, ELEUTHERIOS (1864-1936). He was born on the island of Crete, and was educated in Athens. He worked zealously for the political union of Crete and Greece, and in 1910 became a leader of a new party sponsored by the Military League, which was then working for a reform of the Constitution. That same year, King George I offered Venizelos the office of Premier. He took a leading part in the organization of the Balkan League, and was a prominent figure in the Balkan Wars of 1912-13.

When the World War began in 1914, Venizelos urged that Greece join the Allies, but King Constantine, who had ascended the throne in 1913, was firm for neutrality (the queen was a sister of the German Emperor). The Premier resigned in March, 1915; he was, however, persuaded to form a new Ministry in August, and when the Bulgarian army

was mobilized in September, he insisted, in spite of the king's opposition, that the Greek forces likewise be mobilized.

Then followed Bulgaria's declaration of war upon Serbia. Venizelos demanded that the country take immediate action to carry out its treaty obligation to Serbia. Upon the refusal of Constantine, the Premier again resigned. Finally, in September, 1916, he and his followers set up a provisional government at Candia, on the island of Crete. In June, 1917, Constantine was forced by the Allies to abdicate. Venizelos was then returned to power, and Greece joined the coalition against Germany. Venizelos was the principal representative of Greece at the Peace Conference, but later the loss of territory in Smyrna



VENIZELOS
Photo: U. & U.

resulted in a certain amount of unpopularity (see SMYRNA). After Constantine's return, which he had strongly opposed, in 1920, the great statesman retired to live in Paris. He attended the conference at Lausanne in 1923 at which peace was made with Turkey. In 1924 he was Premier for a short time, but resigned because of poor health.

In 1928 he again took an active interest in public affairs. He assumed the leadership of the Liberal party, and was requested by President Konduriotis to form a Cabinet. In 1932 Venizelos was overthrown. He returned to power with a coalition ministry, but he retired to Crete in 1933, as a result of General Plastiras's *coup d'état*. In 1935 the Cretan Revolt broke out and, on its failure, he fled to Paris. Later in the year King George II was restored and proclaimed a political amnesty, in which the veteran Republican was included. He had been eight times Premier of Greece.

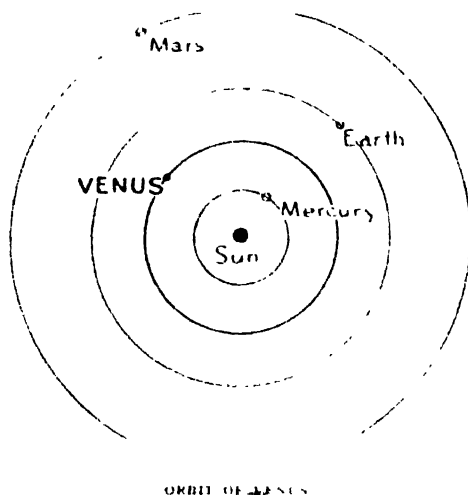
VENTILATION. See HEATING AND VENTILATION.

VENTRILLOQUISM, *ven tril' o kwiz'm*. The art of projecting the voice to make it appear to come from a distant source. The sounds are produced in the usual method adopted in talking; the lips are held as nearly motionless as possible, the tongue being drawn well back, allowing only the tip to move. A deep inhalation is taken and the breath allowed to escape very slowly. Sounds are thus modified by the muscles of the throat and the palate. Consonants are often changed to avoid lip-moving syllables; for instance, the letter *P* becomes a *K*, the word *potato* being pronounced as if it were *kotato*; *B* is treated in the same way, and is quickly slurred into a *G* or *K*. Lack of facial expression on the part of the performer, and his constant direction of the attention of his audience to the place from which the sound is supposed to come, aid in the deception. Ventriloquism is an ancient art, known to the Greeks, who ascribed it to demons. They mistakenly assumed that the voice came from the abdominal region; hence the origin of the word, which is from the Latin *venter*, belly, and *loqui*, to speak.

VENUS. The most brilliant and conspicuous of all the planets, second in distance from the sun. Among the Greeks this planet had two names, *Phosphorus*, or *Lucifer*, the Lightbearer, as morning star, and *Hesperus*, as the evening star. In size, surface, and density, Venus is very similar to the earth. It is at an average distance of 67,200,000 miles from the sun, and its orbit brings it at times nearer to the earth than any other heavenly body except the moon. Eros, a minor planet, or planetoid, and occasionally a comet. Its orbit lies between

Mercury and the earth, and it completes its revolution round the sun in 225 days. Its diameter is 7700 miles, its surface more than nine-tenths that of the earth, and its density very little less than the earth's density. The *albedo*, or reflecting power, of Venus is very great, for it reflects more than half the light which falls upon it.

Atmosphere of Venus. That Venus has an atmosphere is clearly established, and what is seen by us is a layer of clouds floating in



the atmosphere, and not the actual surface. Like the moon, Venus presents different phases, varying from the new moon (crescent to the full circle, and then decreasing, as in the case of the moon.

VENUS. The Roman name for the goddess of love and beauty, whom the Greeks called *Aphrodite*. In legend she is sometimes described as the daughter of Jupiter, or again as springing spontaneously from the foam of the sea. She appears first as the wife of Vulcan, then as companion of Mars and Adonis. She was the patron goddess of lovers and was worshipped by the Romans as mother of the race.

VENUS' FLYTRAP, OR DIONAEA, *di o ne' a*. A plant bearing leaves designed to serve as traps for capturing insects. The insects make up for a deficiency of nitrogenous plant food. Venus' flytrap, in common with most carnivorous plants, grows in soil in which nitrogen is lacking. It is found naturally only in the bogland of North and South Carolina. The leaves are in two parts—a lower, bladelike portion and an upper one consisting of two lobes hinged to a midrib. The surface of each lobe bears a few sensitive, hairlike processes, and the edges are fringed with sharp bristles. An

insect alighting on one of these hairs is caught between the two lobes, which close together like the sides of a trap. The soft parts of the insect are then digested by a fluid secreted by special glands

Scientific Name. The plant belongs to the family *Droseraceae*. Its botanical name is *Dionaea muscipula*

VERA CRUZ. See MEXICO.

VERB. That part of speech which is used to assert something of a person or thing. In a sentence, the verb is the essential part of the *predicate*, and that of which it asserts something is the *subject*. Some verbs express action, and others express being or state of being, as in the following: "The storm wrecked the house"; "The house is a wreck"; "The king *lives*."

Verbs which take or may take objects are said to be *transitive*, verbs which require no objects, that is, which exert no action on objects, are called *intransitive*. There are many verbs, however, which are used both transitively and intransitively, according to the meaning they convey.

There is a group of intransitive verbs used to connect the subject with a predicate noun or adjective, as in the sentences "He is a watchman," "She *looked* interested." These are *copulative*, or *connecting*, verbs, and the most common is the verb *be* in all of its forms: *am*, *is*, *are*, *was*, etc.

The auxiliary verbs are those which make up verb phrases to indicate tense, mood and voice. They are *be*, *may*, *do*, *have*, *might*, *shall*, *will*, *should*, and *would*. In the expression *will run*, *will* is the auxiliary, and *run* is the principal verb.

Properties of Verbs. Verbs have five properties—*voice*, *mood*, *tense*, *person*, and *number*. By this is meant that verbs have varying forms by which they express certain senses

Voice is a quality that belongs only to verbs used transitively. When the verb expresses action on the part of the subject, it is in the *active voice*, as *The teacher read a story*, when the subject is represented as acted upon, the verb is in the *passive voice*, as *The story was read by the teacher*.

Mood (or *mode*) is that property of a verb by means of which we learn its *manner* of asserting; it shows, for instance, whether the sentence states a fact, gives a command, or mentions something regarded as possible or desirable. The three moods are the *indicative*, *subjunctive*, and *imperative*.

Tense. The time and the completeness or incompleteness of an action or condition are indicated by *tense* forms. The chief tenses are—*present*, *past future*, *present perfect*, *past perfect*, and *future perfect*. See TENSE.

Person and Number. When the subject of a verb is a single word of unmistakably singular or plural meaning, the verb should

agree with it in person and number. The verb *be* varies in *am*, *is*, *are*, *was*, and *were* to indicate person and number, and the verbs used after the archaic form *thou* take special forms to show person and number. Otherwise, there is no change to show these two properties, except in the third person singular of the present tense, which adds *s* to the regular form.

VERBENA, *ver be' na*. A genus of plants belonging to the vervain family. Almost all of the wild species are flowering weeds with four-sided stems and opposite or alternate leaves, bearing spikes of small purplish or white flowers. These are commonly known as *vervains*. Cultivated species have flowers of almost every colour except yellow. The plants grow in moist meadows and in waste places

Scientific Names. The genus belongs to the family *Verbenaceae*. The common European vervain is *Verbena officinalis*.

VERCINGETORIX, *ver kin get' er iks*. This strong and active enemy of Caesar was one of the most notable warrior generals who opposed Caesar in the Gallic wars. After the capture of Alesia in the year 45 B.C., concluding fierce fighting over more than seven years, Vercingetorix was exhibited as a captive at the celebration of Caesar's triumph, and was then put to death. This suppression and ending of the great Gaulish chieftain completed the great Roman's campaign, and Gaul was then reduced to the status of a province.

Vercingetorix had been an able antagonist, though he possessed armies much inferior in numbers, he concentrated his forces in strong and well chosen positions, thus avoiding meeting Caesar in open battles. The Romans met with a severe reverse at Gergovia, near the Puy-de-Dôme, the capital of the Arverni, the siege of which he was compelled to raise. Later Caesar inflicted a heavy defeat on Vercingetorix at Veremy near Dijon, and the siege and capture of Alesia, to which the Gaul chieftain retreated, followed.

VERDI, *lair' di*, GIUSEPPE (1813-1901). An operatic composer and the last of the old school of Italian opera. Verdi was the son of a poor innkeeper of the village of Le Roncole. He studied music under Giovanni Provesi, conductor of the Philharmonic Society of Busseto, and later at Milan. In 1833 he was called to Busseto to take the place of Provesi, who had died.

Verdi remained in Busseto for three years, conducting the municipal orchestra and serving as organist of San Bartolomeo Church. In 1836 he returned to Milan to continue his career as an operatic composer. His first opera, *Oberto*, was successfully produced in 1839, but his other early efforts

were disappointing. However, he achieved a real success in 1842 with his *Nabucodonosor*, and this followed with two other operas also well received—*I Lombardi* and *Ernani*.

His work was, however, not outstanding until 1851, when came the production of *Rigoletto*. Two years later, he followed this with *Il Trovatore* and *La Traviata*.

The years between 1860 and 1870 were given over to study and self-education, and their fruit was the immortal *Aida*, which was produced at Cairo in 1871. The great *Manzoni Requiem* followed in 1874, and then, thirteen years later,

came the opera *Otello*. In 1893, when the composer was 80, he produced the culminating work of his career, the opera *Falstaff*. Verdi's remaining compositions were sacred pieces, including the scores for *Ave Maria* and the *Te Deum*. Among operatic composers he ranks with the greatest.

VERDIGRIS, *ver' dig ris*. A poisonous, greenish pigment, made by the action of crude acetic acid on copper. The colour of the pigment varies from blue to green. It is used in dyeing, calico printing, in making Paris green, and in paint manufacture, and sometimes in the preparation of medicinal liniments and salves. Taken internally, it is an irritant poison for which milk and white of egg form an antidote.

VERDUN, *vair dun'*, BATTLES OF. See WORLD WAR.

VERDUN, TREATY OF. Concluded in 843 by the three grandsons of Charlemagne—Louis, Charles, and Lothair. The great empire of Charlemagne had fallen to the emperor's weak son, Louis the Pious, and when he died, in 840, a bitter struggle ensued among his three sons. The war was concluded by an agreement which gave to Louis the region east of the Rhine, to Charles the lands west of the Rhone and the Meuse, and to Lothair the territory between these two sections, extending from the North Sea to the Jura Mountains and the title of Emperor. Louis's Kingdom of the East Franks developed into Germany, that of the West Franks into France. The Middle Kingdom became known as Lotharingia, since softened to Lorraine. The possession of different parts of it, Burgundy, North Italy,

and Lorraine has at various times been contested by the other two.

VERE, *DE*. This family held for generations the Earldom of Oxford. See OXFORD, EARLS OF.

VERGIL, *vir' jil* (PUBLIUS VERGILIUS MARO), also spelt VIRGIL (70–19 B.C.). The name of a great Roman poet, who was born in Cisalpine Gaul, near Mantua, on the bank of the Mincio. After studying at Cremona and Milan, Vergil went to Rome and then to Naples, where he particularly delighted in his work in philosophy under the Epicurean Siron.

In the allotment of spoils to the soldiers of Antony and Octavian after the Battle of Philippi, Vergil, like Horace, lost his paternal estate, and went to Rome to make his living by means of his literary talent. In the capital city he made friends rapidly, despite his extreme shyness. Among these new acquaintances were Octavian and Maecenas, the foremost of the wealthy patrons of letters. The influence of these men secured for him an estate in Campania in place of the one he had lost, and the generosity of Maecenas made it possible for him to live without financial worry, and to devote himself to poetry.

Octavian's friendship for Vergil continued when the former became Augustus, and it was under his encouragement that the *Aeneid* was begun.

When the first draft of the *Aeneid* was finished, Vergil went to Athens, intending to spend several years in Greece and in Asia Minor, revising and completing his great poem. The arrival of the emperor from the East, however, changed his plans, for Augustus prevailed on the poet to return with him to Italy. He did not long survive the journey, for he died a few days after landing at Brundisium. The earliest poems which are with definite certainty ascribed to Vergil are the *Eclogues* or *Bucolics*, written probably between 43 and 37 B.C. There are ten of these, and they are in the main pastoral in character, although only five are strictly pastoral, dealing with the life of shepherds. While these *Eclogues* are based largely on the *Idylls* of Theocritus, Vergil succeeded in imparting to them a distinctly



VERDI
Photo: Brown Bros.



VERGIL
A bust in the Capitoline Museum
Photo: Anderson

Roman tone. The *Georgics* consist of four books on agricultural subjects, dealing respectively with the tilling of the soil, the cultivation of fruit trees, the raising of cattle and horses, and with bee-keeping. This work is the most finished of all Vergil's poetry.

Nevertheless, the *Aeneid* stands as the best-known work of Vergil. Modelled on the *Iliad* and the *Odyssey*, it has distinctive qualities of its own and great poetic power, and is among the finest examples of this type of narrative poem.

VERMICELLI. See MACARONI

VERMIFORM APPENDIX. A narrow, fleshy tube in the lower abdominal cavity, about 3 in. or 4 in. in length. See APPENDICITIS.

VERMILION, *ver mil' yün*. A permanent red pigment of brilliant colour, widely used in the manufacture of paint. It is manufactured by grinding mercury and sulphur together, and treating the mixture with caustic-potash solution, or by heating mercury and sulphur in an iron pan and subjecting the mass to constant stirring. As a result of the latter process, a black sulphide forms. This sulphide, when vaporized in clay retorts, yields the red pigment. Cinabar, or native mercuric sulphide, is also known as vermilion.

VERMONT. A New England State of the United States, it has an area of 9564 sq. miles, and a population (1930) of 359,611. The largest town is Burlington (24,789).

Vermont is a part of the New England upland, broken by fir-clad mountain ranges, cut by deep valleys. The Green Mountains extend nearly the length of the State, from north to south, a little west of the centre of the region. There are many peaks over 4000 ft. Mount Mansfield, the highest, is 4393 ft. high. Along the east shore of Lake Champlain are low foothills at the base of the Green Mountains. In the eastern part of the State is a low range called the Granite Mountains, in which Mount Ascutney rises to 3320 ft.

Lake Champlain, the largest lake of New England, covers an area of over 600 sq. miles. The greater part of this lake lies in Vermont.

The climate is cool-temperate with abundant rain. The average January temperature is 17°, and the average temperature for July is 68°.

Vermont is a rural country, and most of it is fertile. Every uncultivated hill, valley, and plain of Vermont is a pasture or woodland, and only the highest regions are stony and sterile. Over three-fifths of the area is farm land. Hay is the most important crop, followed by potatoes and maize. Apples are the most important fruits. Vermont is, however, pre-eminently a dairy country;

its dairies furnish more than half the daily milk supply of Boston.

The woodland area of Vermont is very extensive. Pine is nearly exhausted, but spruce, hemlock, and hardwoods are abundant. The State is noted for its sugar maples.

Much granite and marble are quarried. Soapstone, limestone, talc, slate, and asbestos are found.

With the utilization of the power furnished by mountain streams, Vermont's manufacturing industries are growing in importance. The manufacture of woollen goods is one of the chief.

The legislative department consists of a Senate of thirty members and a House of Representatives. Each township sends one member to the House of Representatives.

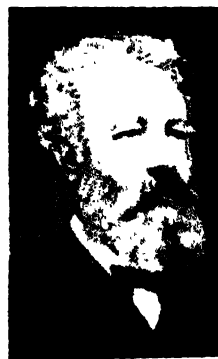
VERMOUTH, *ver' mooth*. This aromatic wine derives its name from the German *Hermuth* or wormwood, the manufacture of which is chiefly in France and Italy. The basis of the product is white wine which by special processes is super-alcoholized and aromatized with wormwood, gentian, and sometimes other herbs, providing a cordial which has marked tonic values. It is especially useful and most liked as an appetizer. The Italian method of manufacture involves dilution with aerated water and sharpening with quinine. Vermouth is used in the mixing of many of the popular "cocktails."

VERNE, JULES (1828-1905). A French writer of fiction, born at Nantes. He was trained for the legal profession but soon began to write stories of travel and adventure in which he visualized developments of modern science.

These stories became remarkably popular and have retained a great vogue, partly due to the fact that many marvels of science visualized by the author have actually been developed. These include the aeroplane and the submarine.

Well known among Verne's stories are *Twenty Thousand Leagues Under the Sea*, *Around the World in Eighty Days*, *The Mysterious Island*, *From the Earth to the Moon*, and *Five Weeks in a Balloon*.

VERNIER, *ver' ni er*. An instrument for measuring lengths and angles with much



JULES VERNE
Photo: Brown Bros

greater accuracy than by an ordinary rule or scale. The vernier slides along the principal scale and measures small fractions of the divisions on the latter.

VERONA, *ver o' na* See ITALY

VERONESE, *ver ro nay' say*, PAUL, or PAOLO (1528-1588) An Italian painter, con-

His most celebrated painting, "The Marriage at Cana of Galilee," contains over 130 life-size figures and heads. It is now in the Louvre.

VERONICA, SAINT The name applied to one of the women of Jerusalem who followed Christ on His way to Calvary (see Luke xxiii. 27), and who is said to have offered Him her linen kerchief, or veil, to wipe the sweat from His brow. Tradition has it that the imprint of His features remained on the cloth, and the miraculous relic is said to have been preserved in Rome since A.D. 700. Other cities, however, claim to possess this relic.

VERSAILLES, *vair sah' e* (in English, *ver saylz'*) The former residence of the French Court and present capital of the department of Seine-et-Oise. The principal feature of the town is the palace erected in 1661 by Louis XIV, and used as a royal residence until the time of Louis Philippe.

VERSAILLES, TREATY OF. When the German "home front" collapsed in 1918 the nation accepted very onerous terms to secure armistice, when later she entered the conference room at Versailles she hoped that American intervention might secure for her more generous treatment, but the Allies—and in particular France with memories of 1871—were still actuated by the animosity engendered by the war. President Wilson had enumerated his famous "Fourteen Points" in a speech to Congress in January, 1918. These were: 1. Open diplomacy (cards on the table) 2. Freedom of the seas in peace and war. 3. Removal of economic barriers. 4. Reduction of armaments. 5. Adjustment of colonial claims in the interests of the populations concerned. 6. Russia to be left unhampered and admitted to the League of Nations. 7. Belgium to be evacuated and restored. 8. France to be evacuated, the invaded portions restored, and Alsace and Lorraine returned to her. 9. Italian frontiers to be adjusted according to nationality. 10. Autonomy for the peoples of the Austrian Empire. 11. Rumania, Montenegro, and Serbia to be evacuated. Serbia to have access to the sea. 12. Autonomy for peoples of the Ottoman Empire. Freedom of the Dardanelles. 13. Poland to be restored on principle of nationality, with access to the sea. 14. Formation of a League of Nations. President Wilson later



PALACE OF VERSAILLES

The Hall of Mirrors (*top*) in which the Versailles Treaty was signed, and (*bottom*) the Hall of Battles.

Photos U. & U.

temporary of Titian and Tintoretto, and the last of the Venetian masters. His real name was Caliori (or Cagliari), but he was called Veronese, from Verona, the place of his birth. His compositions were rich in colouring and ornamental detail, and his execution was truthful; he was skilful in his methods of grouping. Many of his themes were taken from mythology, history, or the Bible. The gaiety and festivity of Venice also furnished him with many colourful subjects.

emphasized that there should be no annexations, no contributions, and no punitive damages. The Allies agreed to treat on this basis, but made reservations in regard to the freedom of the seas and assumed that restoration covered all damage done by German aggression.

The Peace Conference opened at Versailles on 19th January, 1919. Control of the conference passed into the hands of "The Big Four" (Clemenceau, Wilson, Lloyd George,

German East Africa, German South-west Africa, the Cameroons and Togoland) were placed by the League of Nations under Mandate to the Great Powers.

Germany protested strongly against the provisions of the treaty and particularly against a clause saddling her with the entire guilt of the war, but was forced to sign, and to submit to military occupation of the Rhineland until substantial payments had been made. Germany later denounced some of the most important provisions, and has left the League, re-armed, re-fortified the Rhineland and asserted her sovereignty over the internationalized rivers and the Kiel Canal. See also LOCARNO CONFERENCE, RUHR; WAR DEBTS.

VERSE. A metrical form which may be poetry or "rime doggerel." Metrical arrangement depends mainly on the number of syllables and the placing of the accent. See METRE; POETRY.

VERTEBRAE. See SKELLTON.

VERTEBRATES, *ver' te brayts*. In zoölogical classification, the term applied to animals that possess a bony spinal column, or backbone. This supporting axis is made up of segments called *vertebrae*, to which are attached the ribs and the bones supporting the jointed limbs. In the majority of vertebrate animals, the layers of the skin are soft, as in man, and are provided with hair, feathers, scales, and nails for protection and ornament. There are six classes of vertebrate animals: *Cyclostomata* (lampreys); *Pisces* (fish); *Amphibia* (frogs, etc.); *Reptilia* (reptile); *Aves* (birds), *Mammalia* (mammals).

The vertebrates form a subdivision of the phylum *Chordata*. This name means "having a cord." In the lower chordates, there is, at some period in their history, a supporting rod of cellular tissue—the *notochord*—that is regarded as the forerunner of the backbone of vertebrates. The notochord is found in the embryo of a typical vertebrate animal but serves as a transitory structure upon which the vertebral column develops.

VERTIGO, *ver' ti go*. The condition popularly known as *dizziness*. The victim of vertigo has the feeling that objects before him are whirling about, or that he himself is falling. If he attempts to walk, he staggers or falls down. There are various causes for this distressing sensation, including excessive or defective supply of blood to the brain, and variations in the pressure of the fluid in the semicircular canals of the internal ear (see EAR). Vertigo is often an accompaniment of anaemia, epilepsy, heart trouble, eyestrain, or of indigestion.

VERULAM, BARON. A title granted in 1618 to Francis Bacon. See BACON, FRANCIS.



THE TABLE IN THE HALL OF MIRRORS
AT VERSAILLES AT WHICH THE PEACE TREATY
WAS SIGNED

Photo Keystone

Signor Orlando), but the influence of Italy rapidly waned, and Orlando temporarily withdrew when the Italian claim to Fiume was disallowed. The main principle of the conference became the fixing of racial rather than traditional frontiers, which sometimes seriously conflicted with secret treaties made previously.

The treaty made provisions for future peace (Covenant of the League of Nations, see LEAGUE OF NATIONS), forced Germany to surrender territory to France, Belgium, Denmark, and Poland (the "Corridor" to the sea), and to surrender her colonies. Germany was saddled with heavy Reparations payments. Germany's army and navy were to be reduced; she was to have no air force and the Rhine fortifications were to be destroyed. Union with Austria (*Anschluss*) was forbidden. All German colonies

VERVAIN. See VERBENA.

VESPASIAN, *ves pay' zhan* [TITUS FLAVIUS VESPASIANUS] (A.D. 9-79). Roman emperor from A.D. 70 to 79. As commander of a legion he won distinction in Britain and in Germany in the reign of Claudius. In 51 he was elected consul, in 63 became governor of Africa, and in 66 was placed in command of the Roman forces in the Jewish war. Before this was brought to a conclusion, news arrived of Galba's death, and Vespasian's soldiers proclaimed him emperor. Otho and Vitellius had been put forward by rival factions, but in 70 Vespasian entered Rome as sole ruler of the empire.

After the capture of Jerusalem by his son Titus, which ended the Jewish war, father and son shared in a triumph, in commemoration of which the Arch of Titus was built. The great Colosseum was begun by Vespasian and finished by his son Titus. As a soldier Vespasian proved himself a man of courage and foresight. As a ruler he retained the support of the army and governed with a strong but benevolent hand.

VESPER. Among several kindred meanings, this term may denote the seventh of the eight canonical "hours" in the Roman Catholic Liturgy, said or sung towards evening; evening prayers or devotions, and the evening song of a bird. At the universities the term is used to indicate the ceremonies immediately preceding the commencement of a Bachelor of Arts, and at Oxford University they specify the eve of the act—the day on which these ceremonies are held.

VESPUCCI, *ves pool' che*, AMERIGO (1451-1512). An Italian merchant explorer, said to have been the actual discoverer of the Continent

of America and after whom the continent is named. After being engaged for a time in trade, at first in his native city and later in Seville and in Cadiz, Spain, in 1495 he became connected with a firm which fitted out vessels for long voyages, and had fitted out the second expedition of Columbus (1493).

According to Vespucci's own account, he sailed with a "free-lance" expedition from Cadiz on 10th May, 1497, and this expedition reached the coast of Mexico and Central America a few days before Cabot reached North America, and at least a year before Columbus reached the mainland of South America. His account has been generally

discredited, and the honour of discovering America is probably rightly assigned to Columbus. His second voyage in 1499 is reported to have led to the discovery of Brazil, and a third in 1501 is said to have reached lat 50° S on the coast of South America.

VESTA. Roman goddess of the hearth, whose shrine was in the inner part of every house. Her temple, circular in form, was situated in the centre of Rome. Here she was worshipped under the symbol of the eternal fire, watched over by the six Vestal virgins. Their most important duty was to keep this sacred fire burning. Every community had its hearth where a fire was constantly burned in her honour, and colonists, upon leaving the city, took with them some of the old fire to kindle a flame in their new home. The great festival in honour of the goddess, called the Vestalia, was celebrated on the 9th of June.

VESTAL VIRGINS. See VESTA, above.

VESTMENTS. In general, clothing, in particular the ceremonial garments worn by priests performing the offices of religion. Modern vestments have developed from forms of dress common under the Roman Empire and not, as has sometimes been argued, from symbolic origin. Special vestments for liturgical use were being employed in the fourth century A.D., but their form did not materially differ from the general secular dress. Between the sixth and the ninth centuries, however, major changes in secular dress were not followed by the church, which retained the old forms, though, by the middle of the ninth century, liturgical vestments were worn over, not instead of, ordinary dress. Between the ninth and the twelfth centuries the character changed and the number increased, shoes, stockings, mitre, gloves, and surplice being introduced. Ornament, which previously had been lacking, was adopted and both embroidery and jewellery gradually gained increasing prominence. After the Reformation the extreme reformers, in addition to their opposition to set forms of worship, opposed also the wearing of vestments by the clergy. So far as the Church of England is concerned, an attempt to regulate the position was made by the Second Prayer Book of Edward VI. This, however, was swept away in the reign of Mary, but its reinstatement was intended in subsequent rather muddled legislation. Divergence of opinion as to the exact meaning of this has led to the respective attitudes of the High and Low churchmen.

VESUVIUS, *ve sü' vius*. A volcano situated on the Bay of Naples, about 7 miles south-east of the city of Naples.



AMERIGO VESPUCCI
Photo: Brown Bros.



RELIGIOUS VESTMENTS

1 and 2. Front and back of a modern Cope (Louis Grosje). 3. Archbishop of the twelfth century. 4. Priest of the seventh century. 5. Stole. 6. Manipule. 7. Bishop in Pontificals. 8. Priest in Chasuble and Alb (Vauchons). 9. Dalmatic. 10. Bishop's Liturgical shoe of the thirteenth century. 11. Bishop's Glove.

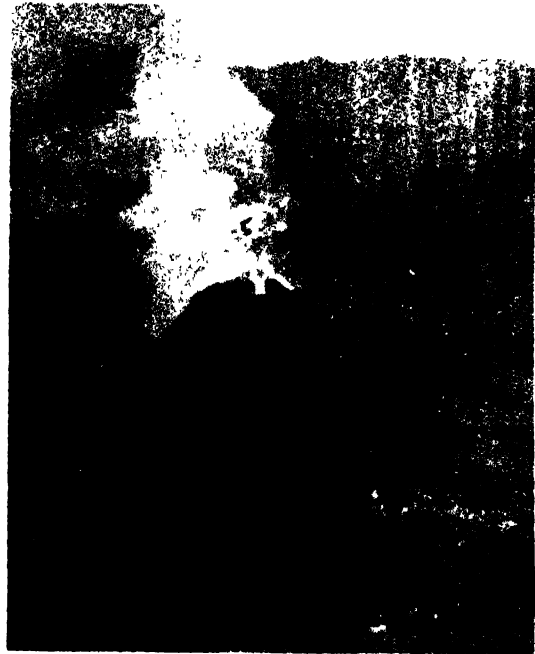
Roman legends that the gods once used the fields about Vesuvius as a battleground indicate that prehistoric men had seen the mountain in eruption. Centuries of quiescence followed until A.D. 63; then a succession of earthquakes, during the next sixteen years, alarmed the neighbourhood. The first recorded eruption of Vesuvius occurred on 24th August, A.D. 79, when the cities of Herculaneum, Pompeii, and Stabiae were destroyed. Since the year 79, eruptions of greater or less violence have taken place at varying intervals. The greatest loss of life within recent years occurred in April, 1906, when several towns and villages in the vicinity were destroyed, and the height of the cone was reduced over 1200 ft. Another eruption occurred in 1929.

VETCH. The common name of a genus of leguminous, or pod-bearing, plants used for hay and pasturage. Vetches are also grown for seed, which is fed to stock. *Common vetch*, or *tare*, and *hairy vetch* are the most common species. The vetches are plants of trailing habit, and are often sown with oats and rye, as the latter have stiff stems that serve to keep the weaker plants off the ground. The vetches belong to the genus *Vicia*, family *Leguminosae*. See TARE.

VETERINARY SCIENCE. As an "art" the practice of Veterinary Medicine dates back into the distant ages, for the "Doctor of Horses and Asses" is referred to in the Laws of Hammurabi (2100 B.C.), whilst one of the books of Aristotle's *Historia Animalium* is devoted to Veterinary Medicine, and treatises on horses were written by Simon of Athens and Xenophon; but, as a "Science," its rise commences from a much later date, and its start in Great Britain can legitimately be stated to have been due to the efforts of the Odiham Agricultural Society, whose members in 1791, aided by a number of influential noblemen and owners of stock, started a veterinary college in London under the professional guidance of a distinguished French veterinary surgeon, M. Charles Vial St. Bel, a graduate from the Lyons Veterinary College in France.

This was followed a few years later by the establishment of another college in Edinburgh under the control of its founder, William Dick, and at the present time a prosperous institution in that city, known world wide as the Royal (Dick) Veterinary College. It is on the foundation laid by these two colleges that the structure of Veterinary

Science, as we know it in Great Britain to-day, has been built: and at later dates there has been added a school at the University of Liverpool, together with the colleges at Glasgow and Dublin. With all, however, there is a common syllabus of teaching for the courses which have to be followed in order to obtain the Diploma of the Royal College of Veterinary Surgeons



VESUVIUS IN ERUPTION
Photo: U. & U.

(the only British licence under which a man, or woman, can use the title of Veterinary Surgeon); and these regulations are set by the Council of the Governing Body of the Royal College of Veterinary Surgeons. This Body has complete control of the laws which rule the etiquette of the members of the profession, the courses of study and conduct which the students must follow, and the examinations which they must pass; and wherever they receive their education, they all have to enter through the one portal, i.e. qualify by passing the examinations of the Royal College of Veterinary Surgeons. This keeps the standard uniform. The matriculation examination is of identically the same standard as for human medicine, and full details of the professional subjects to be taken can be obtained upon application to the Registrar at 10 Red Lion Square, London, W.C.1. The course takes

five years for the Diploma, or six years for the University post-graduate degree; and degrees in Public Health and Tropical Medicine are afterwards granted to those who desire to specialize in these subjects.

According to the Statistics of the Ministry of Agriculture and Fisheries (1936) there are still over 1,000,000 horses, more than 6,000,000 cattle, some 13,000,000 sheep, and over 4,000,000 pigs in Great Britain alone, whilst the value of the poultry industry is more than double that of wheat.

When one adds on to this the domestic pets such as the dogs, cats, small animals, and cage birds—each of which run into millions—whose added value is measured by sentiment as well as actual cost and utility, it can readily be seen that there is an enormous field in which the trained and scientific veterinarian can exercise his judgment and skill.

It is not only, however, for the benefit of the animals themselves that his skill is necessary, for veterinary and human medicine are so clearly allied together that many of the diseases of animals are also contagious to man; and in some instances—such as for example, glanders in the horse, and rabies in the dog—when once the disease is eradicated from the animals it also automatically disappears from man.

Here the veterinary surgeon is of great value to his medical *confrère*, and in an island country like Great Britain, when once a contagious animal disease is thoroughly "stamped out" it only requires the rigid

application of certain regulations of the Ministry of Agriculture in respect of tests and quarantine precautions to control its re-introduction.

The British public are now realizing the value to the nation, from the economic and health point of view, of an efficient Veterinary Service, for agriculture is the backbone

of all civilized countries, and the prosperity of agriculture depends upon its animals. The wealth of the owner of the animals depends upon the health of his stock and their freedom from epidemics, and this must depend upon the man who is scientifically trained to combat animal diseases, i.e. the Veterinary Surgeon. *It is far better to prevent diseases than to cure them*, although a knowledge of each is equally necessary. It is, however, not only with the cure of the living animal that veterinary science is concerned, for the work of the trained veterinarian also carries him into inspection duties over the flesh (and other products) of those which



VETERINARY SCIENTISTS

Above: A laboratory in the Hygiene Department of the Veterinary Institute in Germany. *Below:* The ambulance section of the Veterinary Institute operating a horse at a farm

Photos G. Slaté Railways

are used for the food of man. The duties involved in curing infections of meat and milk are legitimately those of the veterinarian.

In England, to our shame, there are still large numbers of private slaughter-houses, from which animal carcasses are taken direct to the butchers' shops without any veterinary inspection whatever, and were it not for the fact that the average Englishman cooks his food well we should run grave risks.

Scotland, the Colonies, and all the Continental countries are up to date in this



ARTIFICIAL LIMB WITH FLEXIBLE JOINT

It is made of silver and vulcanite and has a false paw

Courtesy Sir Frederick Hobday



DOG WITH A GLASS EYE

(Left) Japanese Spaniel before a glass eye was inserted

(Right) The eye in place

Courtesy Sir Frederick Hobday



SHEEP DOG WITH FALSE LEG

The leg is made of leather with a wooden stut

Courtesy Sir Frederick Hobday

respect, whilst England lags behind. The destruction of home-produced meat condemned as tuberculous alone costs hundreds of thousands of pounds annually, and in addition, to reckon this disease alone in terms of £ s. d.—not to mention the losses by death and human illness from drinking infected milk—the depreciation in the value of the milking herds through preventable wastage may be considered to be at least £2,000,000 a year; and it is estimated that tuberculous milk causes the death of more than 2500 children under 5 years of age alone every year.

It is in order to counteract this and other wastage that a State Veterinary Service has now been formed, and at last, a great effort is being made to eradicate the tuberculous cow.

It is not only, however, on the public health side that veterinary science has progressed, as in clinical medicine and surgery the advances have been equally great, and the veterinary surgeon is now able to restore to health and usefulness animal patients for whom in past days the bullet or the lethal chamber would have been the only solution.

Aided by careful nursing and attention to modern method of treatment and hygiene the animal patient with pneumonia or other serious diseases is treated scientifically by up-to-date methods, with prospects of ultimate recovery, under the application of vaccines, sera, and other modern adjuncts, which were unthought of years ago, and in surgery the marvels of false limbs, glass eyes, and even false teeth are quite well known. The use of chloroform and other anaesthetics, too, is universal, and, in fact, there is very little which man has done to him when ill which is not now applicable to the four-footed creatures.

VETO, THE The power to forbid the passing of a law. In England a bill has to pass both Houses of Parliament and receive the Royal Assent. The Parliament Act of 1911 made the veto of the Peers suspensory, not final, if a bill is thrown out thrice by the Lords after being thrice passed by the Commons, with no General Election supervening, it may nevertheless be presented to the Crown. It is commonly, but inaccurately, stated that the Royal Veto no longer exists. The Veto is conveyed in the words *Le Roy s'aviserà*.

VEXILLUM, *vex il' um*. The standard of a unit—or the unit itself—in the Roman army. The Romans carried two types of standard, the *Eagle*, or formation standard, of which one only was entrusted to each legion, and the *Vexilla*, or unit banners.

The latter displayed the badge of the unit in some form, and were carried by cavalry and auxiliary units, as well as by regular troops. The loss in battle of a vexillum was deemed a grave disgrace to the troop or unit concerned.

VIADUCT, *vi' a dukt*. A long bridge, carrying a roadway or railway tracks across a valley, gorge, highway, or shallow waters. The term is also often applied to the elevated roadways built in cities to relieve the congestion of streets, as, for instance, the well-known Holborn viaduct in London. The commonest kind consists of a series of short spans of steel or concrete, supported by steel and concrete piers.

The pier viaduct crossing the mouth of the River Tay, Scotland, has eighty-five spans and is 10,500 ft. long. Another famous viaduct is the Landwasser across the Albula Pass, in the canton of Grisons, Switzerland.

VIATICUM, *vi at' ik um*. The last communion, or Holy Eucharist, administered to the dying, or to those in danger of death. It may be administered in extreme cases without fasting being required, as otherwise is the case, and it may be given several times during protracted illness. It is given before Extreme Unction (which see). The word means in Latin "provision for a journey," and in the early Christian Church, it was applied to anything that gave spiritual comfort to the dying.

VIBRATION. See PENDULUM; SOUND.

VICAR. A person, especially an ecclesiastic, who is appointed to perform duties in place of a superior. In the Roman Catholic Church, the Pope, since the eighth century, has had the title of Vicar of Christ on earth. In the Anglican Church, a vicar is a clergyman in charge of a parish where the main tithes go to a rector, for whom he acts as deputy.

VICENZA, *ve chen' isa*. See ITALY.

VICEROY, *vis' roy*. An official who rules a province or colony in the name of a sovereign. The name means, literally, *vice-king*. The chief executive of British India is both Viceroy (as representative of the King for the self-governing States) and Governor-General (head of British India). This title was also applied at times to the Lord Lieutenant of Ireland, before the organization of the Irish Free State, in which the representative of the Crown was called *Governor-General*. In December, 1936, the President, De Valera, expressed an intention to abolish this office.

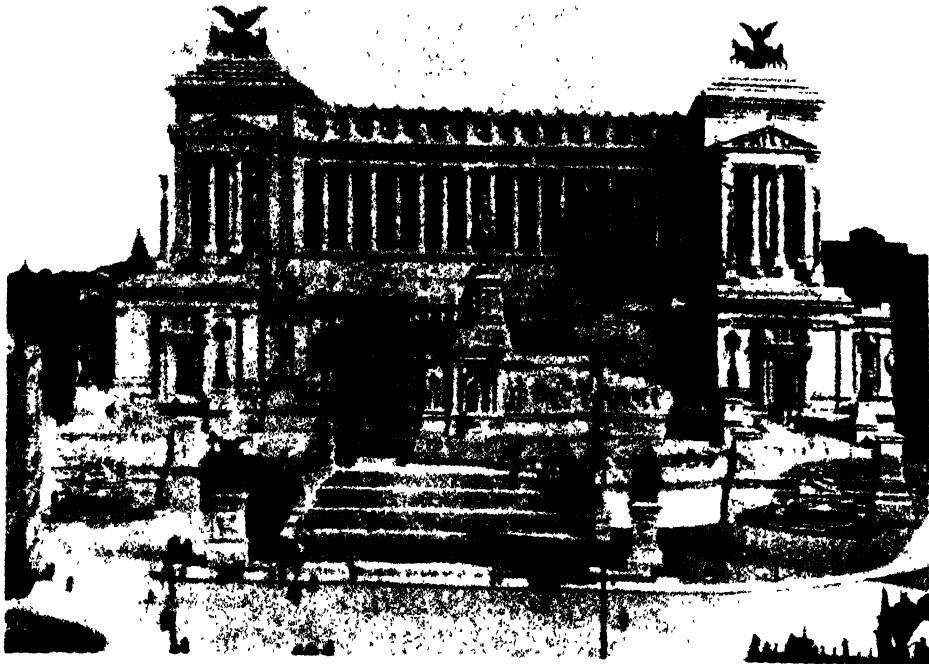
VICTOR EMMANUEL. The name borne by a king of Sardinia and by two of his descendants, who became kings of Italy. The latter were the following—

Victor Emmanuel II (1820-1878). King of Sardinia from 1849 to 1861 and the first king of united Italy. He was born at Turin, and received a military training. Becoming involved in a struggle with Austria, and thinking that his son could obtain better terms from that country, Charles Albert, his father, abdicated in his favour in 1849, after a defeat at Novara. Victor Emmanuel refused to suppress, at Austria's suggestion, the Piedmontese constitution, and he was increasingly regarded as the only centre of Italian unity, Mazzini's republicanism having been discredited by the turmoils of 1848. His celebrated and broad-minded minister Cavour, assisted him to regulate and improve financial conditions, to reorganize the army, and to secularize church property.

On the advice of Cavour, Sardinia joined England and France in the Crimean War. In 1859 war was declared by France against Austria, and the Austrians were disastrously defeated at Magenta and Solferino, but Napoleon III then arranged the armistice of Villafranca. Cavour wished Sardinia to continue a lone struggle, at the risk of angering France, but the king showed a wise restraint. By the peace of Zurich, Austria ceded Lombardy to Sardinia.

In 1860, Tuscany, Parma, and Modena were annexed to the dominions of Victor Emmanuel. Garibaldi turned over Sicily to the King, and Umbria, throwing off the authority of Pope Pius IX, was annexed to Italy. Victor Emmanuel was proclaimed King of united Italy on 17th March, 1861. In 1866 Venetia was ceded to Italy by Austria, and on the withdrawal of the French garrison from Rome in 1870, that city was annexed and became the capital of the country. A great asset to the new nation was the king's personal popularity, won by his rough cordiality, his unquestioned courage, and the self-sacrifice which made him, in the interests of Italy, cede away his ancient patrimony, Savoy. On his death, in 1878, Victor Emmanuel II was succeeded by his son, Humbert I.

Victor Emmanuel III (born 1869). A just and generous ruler who early won the respect and confidence of his people; the only son of King Humbert I and Queen Margherita; was born in Naples. In early life he gained considerable knowledge of military affairs. In 1896 he married Princess Elena, daughter of Prince Nicholas of Montenegro; their children are Princesses Yolanda, Mafalda, Giovanna, and Maria, and Prince Humbert. In 1900 King Humbert



MONUMENT IN ROME TO VICTOR EMMANUEL II

was murdered by an anarchist. The new reign was disturbed by much social unrest. The political situation was long dominated by Giovanni Giolitti, "the Man of Dronero."

In 1915 Giolitti insisted that Italy should remain neutral, and the Premier, Antonio Salandra, who advocated war with Austria, was driven to resign. The king refused to accept his resignation and war was declared. The king remained constantly in the field, visiting the trenches, enduring hardships, and exposing himself to dangers.

KING VICTOR
EMMANUEL III

In the disturbed years after the war it was due to his good judgment and intuition that the dynasty was not endangered. When the Fascisti marched on Rome, in October, 1922, a decree proclaiming martial law throughout Italy had been

prepared by the government at Rome, but the king refused to sign it, and thereby probably averted civil war. Since then he has co-operated cordially with Mussolini; Fascismo, which originally had republican elements, has become increasingly devoted to the Throne. An outstanding event of his reign was the restoration of the temporal power of the Papacy, in 1929.

VICTORIA (1819-1902). QUEEN OF GREAT BRITAIN AND IRELAND, AND OF THE BRITISH DOMINIONS BEYOND THE SEAS, EMPRESS OF INDIA. Alexandrina Victoria, daughter of Edward, Duke of Kent, fourth son of George III, was brought up in seclusion at Kensington Palace, her birthplace. Her widowed mother (see WILLIAM IV) jealously regulated the externals of her life, but a far deeper influence was that of Baroness Lehzen, and on her accession in 1837 her mother's importance abruptly ceased. Apart from Lehzen, Victoria's confidential adviser was her uncle, Leopold I of Belgium, whose letters of counsel she eventually came to resent.

By 1837 the prestige of the Crown had been seriously weakened. After the unamiable early Hanoverians, George III had been loved, but his reign had petered out in lunacy. George IV had been the centre of innumerable scandals; the courage and honesty of William IV had been masked by

his eccentricities. The Royal House was viewed with derision by society and with indifference by the people, the chief recommendation of the new Queen, of whom personally little was known, being the unpopularity of Cumberland, her uncle and heir. At her earlier public appearances there was little cheering and few heads were bared. Sixty years later her Diamond Jubilee roused the Empire to demonstrations of passionate loyalty.

In person she was short, pleasing rather than pretty, and of a "surprising dignity." She had been carefully educated and was endowed with a clear, practical intelligence. Her outlook was narrow and her imagination limited, to the exasperation of statesmen with more subtle intellects or more ardent ideals, but she had much shrewd common sense, and her moderating influence was valuable, if often unappreciated. She had a genuine devotion to her people, a strong sense of responsibility and a resolute courage. Her Court may have been dull, but it certainly commanded respect. It was her husband who "insisted on spotless character" in Court appointments, "the Queen not caring a straw about it," until his influence had become dominant.

A strong affection developed between Victoria and her first Premier, Lord Melbourne (see MELBOURNE, LORD), to whose patient training she owed much. His good nature and lack of party prejudice fitted him admirably for the task. He trained her in Whig principles, with the result that, although the prestige of the Crown was enormously heightened in her reign, the prerogative steadily declined. The strongest influence in her life was that of her cousin, Albert of Saxe-Coburg-Gotha, whom she married in

1841. His tact, his statesmanship, his organizing ability, his interest in art and science, all greatly benefited the country, although he was long resented as a foreigner. The diplomatic Count Stockmar served them both well. Lehzen unwisely showed jealousy of the Prince and was dismissed in 1842.

The events of the long reign can only be summarized. Hanover, under Salic Law,

passed to the Duke of Cumberland. In 1839 Sir Robert Peel, whose manner the Queen at first disliked, requested her to change her Whip ladies of the bedchamber for Tories, and resigned his new Premiership when she refused. An unfounded scandal reflecting on one of her ladies in waiting had been given publicity by Conroy's malice, and this appears to have deepened her determination to keep control over her household. On Peel's return to power in 1841, the Whig ladies resigned before the bedchamber question could arise again.



QUEEN VICTORIA
Photo: Brown Bros.

In 1846 Peel split the Tory party by repealing the Corn Laws (which see, also FREE TRADE), and for the rest of the reign Protectionist theories were discounted. Lord John Russell became Premier. 1848 saw the fall of Louis Philippe and of Metternich, and risings in most of Europe. In England, Feargus O'Connor and his working-class followers, having realized that from the much-desired Reform Bill of 1832 they benefited not at all, demanded a People's Charter (see CHARTISM). Lord Palmerston at the Foreign Office embarked on adventurous policies, often not ascertaining or even defying the wishes of the Sovereign and the Cabinet. The Queen urged his dismissal, but Russell feared his influence with the Radicals. In 1851 he expressed approval of the *coup d'état* of Louis Napoleon,

anathema to the Radicals, and Russell forced him to resign. This was the year of the Great Exhibition in Paxton's "Crystal Palace" in Hyde Park; its inception and its success were largely due to Prince Albert, who was also responsible for the decoration of Buckingham Palace and of the new royal homes, Balmoral and Osborne House.

In 1852 a short-lived Conservative ministry under Lord Derby was succeeded by a coalition of Whigs and "Peelites" under Lord Aberdeen. Their respective Chancellors of the Exchequer were Disraeli and Gladstone, and politics gradually came to centre upon the antagonism of these two, the Imperialist and the domestic Reformer. The Queen, at first prejudiced against Disraeli, was completely won over by his wit and charm. With Gladstone she was never in harmony. Strict constitutional propriety on one side and loyal respect on the other eased, but did not heal, their differences.

The coalition blundered into the Crimean War (which see), and Palmerston became Premier. This war is said to have broken the Great Peace since Waterloo, but the peace had long been broken in the East. In two wars—1839 to 1842, and 1856—Britain had forced opium, missionaries, and traders on reluctant China. In 1838, Dost Mohammed Khan, Amir of Afghanistan, was dethroned, being suspect of intrigue with Russia. In 1842 he returned and a British detachment was annihilated, save for one man, in the Khyber Pass. In that year Sir Charles Napier conquered Sind. In 1845 and 1849 were the Sikh Wars, Lord Gough and General Whish winning the decisive victories at Chillianwallah and Gujarat. The reforms of Lord Dalhousie probably helped to cause the mutiny in 1857. A Secretary of State for India was appointed in 1858.

A Derby Ministry in 1858 and 1859 encouraged the volunteer movement and admitted the Jews to Parliament. Palmerston then holding office until his death in 1865. Britain took no share in the Italian struggle or in the American Civil War. The *Alabama*, which tried to break the Federal blockade on the cotton ports, was a private venture, although Britain later paid for the damage she had done.

In 1861 died Albert, Prince Consort since 1857. The blow to the Queen was overwhelming. For years she shut herself away from her people, protesting that to ask her to make a state appearance was heartlessly unfeeling. Time seemed to bring no lightening of her grief, and her people passed from sympathy to wonder and then to incredulity, with the result that the seventies saw the growth of a Republican movement, which won the support of some rising men,

including Sir Charles Dilke and Joseph Chamberlain. In 1872 Edward, Prince of Wales, fell ill of typhoid fever, and Republicanism was smothered in the general sympathy and sorrow. On his recovery, the Prince increased his social duties and the feeling of discontent did not revive. Gradually the Queen made more frequent appearances, until she had won back her popularity, to which came to be added a reverence extorted by her years.

A Conservative ministry, from 1866 to 1868, passed a Reform Bill—"to dish the Whigs"—extending the franchise to the town labourer, transferred disputed elections to judicial decision, and sent Sir Robert Napier to defeat Theodore of Ethiopia at Magdala. Gladstone then disestablished the Irish Church, passed a generally despised Irish Land Act, a Ballot Act, an act creating the High Court of Justice and another opening the Universities to others than Anglicans. Forster introduced national education and Cardwell reformed the Army. Disraeli came in in 1874. Next year he bought shares in the Suez Canal, proclaimed Victoria as Empress of India—*Kaisar-i-Hind*—in 1877, and checked the designs of Russia at the Treaty of Berlin in 1878. The second Afghan War in 1878 deposed Sher Ali, the third, in 1879, enthroned Abdurrahman Khan, General Roberts making a famous forced march from Kabul to Kandahar.

In 1881 Gladstone, again Premier, had to send troops to Egypt against Arabi Pasha, and in 1881 he sent General Gordon to the Sudan, in which El Mahdi had preached a holy war. Gordon was killed in 1885. A Reform Bill in 1884 gave the vote to the country labourer. In 1885 and 1886 came short-lived ministries under Lord Salisbury and Gladstone, who declared for Home Rule. The Queen's Jubilee was held in 1887. After six years of power Salisbury gave way to Gladstone who in 1894, after the Lords had rejected Home Rule, retired and was replaced by Lord Rosebery. A year later, Lord Salisbury was again in office. In 1897 the Diamond Jubilee roused even greater enthusiasm than that of ten years before. In 1898 Sir Herbert Kitchener pacified the Sudan. The Jameson Raid was in 1896, and the South African War broke out in 1899.

The Queen was not fated to see peace again; she died at Osborne on 22nd January, 1901. Her long reign had witnessed amazing changes. The electric telegraph, the telephone, the gramophone, the camera, and anaesthetics were among the scientific improvements. Politically, the changes included the rise to power of the middle class and the adumbration of the Labour movement. The most important Imperial change

was the granting of self-government to the dominions. In 1901 nearly all those who had seen these and so many other changes taking place had always been aware of one constant, one settled figure, slowly changing yet essentially always the same—the Queen. She had been the pivot of England in her subjects' youth and in their fathers' youth, apparently defying the chances of mortality. It is no wonder that, on the news of her death, men felt that a great era had ended and drifted black-clad and uneasy through the silent streets.

VICTORIA, PRINCESS ROYAL OF ENGLAND, EMPRESS OF GERMANY (1840-1901). The eldest child of Queen Victoria was fortunate enough, according to the Greville Diary, to marry for personal, not diplomatic, reasons. When she was fourteen, Frederick William, Crown Prince of Prussia, came to England, proposed, and was accepted. They were married in 1858. She took a warm interest in her new country and was zealous for Anglo-German friendship. In 1888 her husband, to whom she was devoted, succeeded as Emperor, but he was already dying from a throat disease. She was attacked by the Press and disapproved by Bismarck, being suspect of encouraging her husband in his liberal and pro-English views. With her son, William I, she was on bad terms.

VICTORIA. A State of the Commonwealth of Australia, in the south-east of the continent; it has an area of 87,884 sq. miles.

Victoria is the most densely populated State in the Commonwealth, and has a population of 1,838,000 (1935). Nearly 98 per cent of the inhabitants are of British descent, and over half the people live in Melbourne.

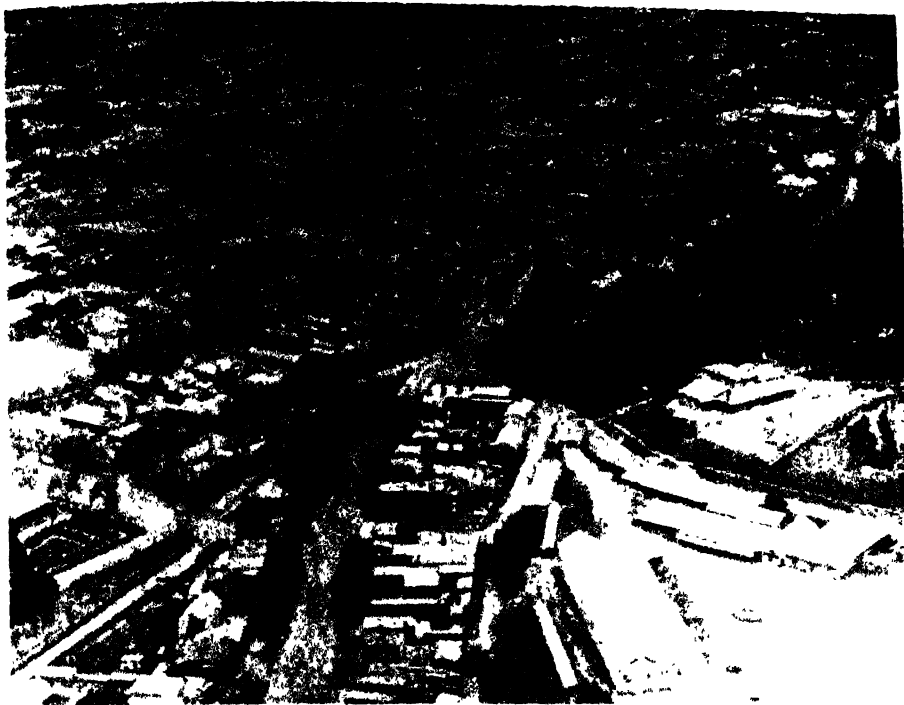
Physical Features. The coast line is extremely irregular. Chief among its numerous indentations is the magnificent Port Philip Bay, with an area of 875 sq. miles and an entrance barely 1 mile wide, affording safe anchorage for the largest ships. At the head of this bay lies the city of Melbourne.

The eastern part of Victoria is crossed by the Australian Alps, whose highest peak, Mount Bogong, has an altitude of 6508 ft. The mountains are covered with dense forests of eucalyptus or gum trees, some of them being of great size. The Victorian highlands continue those uplands towards the west. The north-western part consists of level or slightly undulating grass covered plains. In the south are ranges of low hills, and across nearly the whole length of the State stretches, between the uplands, the fertile valley of Victoria. The chief river, the Murray, for a distance of over 670 miles, forms the northern boundary of the State, separating it from New South Wales.

Victoria has a warm and pleasant climate. In the lowlands, the temperature seldom reaches the freezing point, but in summer the thermometer sometimes registers over 100° F. in the shade. The rainfall is usually



BIRD SANCTUARY IN VICTORIA, AUSTRALIA
A Commonwealth Government cameraman photographing bird life on the Moira Lakes, near the Murray River, which is the nesting-place of thousands.
Photo: Australian Trade Publicity



BENDIGO, VICTORIA

Formerly a gold-mining centre, this city of 34,000 inhabitants is now the commercial centre of the rich northern fruit and wheat districts. It is 101 miles north of Melbourne.

Photo: Australian Trade Publications

regular and abundant, but droughts sometimes occur.

Production. Victoria is the chief agricultural State in the Commonwealth, and has 4,500,000 acres of land under cultivation, aided in parts by irrigation. The chief crops are wheat, oats, barley, potatoes, and hay. Grapes take the lead among fruits, and much attention is given to the production of wine. Stock-raising is extensive, and dairy-farming is well developed. Sheep-raising forms one of the chief sources of wealth, the State having over 16,700,000 sheep, mostly in flocks of 500 to 5000 head. Five millions of acres of forests are filled with fine timber.

The chief mineral wealth of Victoria formerly consisted in its gold deposits, but gold-mining has declined. Coal is now of some importance, but much is brown coal. Other minerals found are silver, tin, and gypsum.

Commerce. The principal exports are wool, dairy products, wheat, vine products (grapes, raisins, and currants), wine, and gold. The State has over 4700 miles of

railways, which radiate from Melbourne, its chief city and port. The railways are owned by the government.

Government and History. The governor, appointed by the king, has a cabinet of ministers. The legislature consists of an upper house of thirty-four members, elected for six years, and a lower house of sixty-five members, elected for three years. Victoria sends six Senators and twenty-one Representatives to the Federal Parliament.

The first permanent settlement in this part of the continent was made in 1834, and in 1851 the colony was incorporated within the territory of New South Wales. In 1851 it was constituted a separate colony and named Victoria. The discovery of gold in that year brought large numbers of settlers into the State, which developed rapidly. Victoria has kept pace with its sister States in enacting advanced legislation along the lines of social and political democracy.

Victoria has two cities of importance besides Melbourne, the capital, which has a separate article.

Ballarat, bal a rat, the largest inland



VICTORIA FALLS

Photo Percy M. Clark. Courtesy: Southern Rhodesian Publicity Bureau

city in Australia, 74 miles north-west of Melbourne, was formerly the centre of one of the richest gold-yielding districts in the world. The goldfields are now, apparently, nearly exhausted. In 1851 it was the scene of a most remarkable "gold rush," during which the largest nuggets ever unearthed were found, one specimen being sold for £10,000. The surrounding district is particularly suited to sheep-breeding, and great quantities of wool are exported. There are also distilleries, flour mills, and iron foundries. Population, 37,850 (1934).

Geelong is a port on Corio Bay with a woollen export trade, also the centre of an important cattle-raising area. It has woollen and paper manufactures, tanneries, and meat-preserving plant. Population 39,400.

VICTORIA, BRITISH COLUMBIA. The capital city and, with the exception of Vancouver, the largest city in the province. Population, 39,062 (1931).

Shipbuilding and the repairing of ships constitute a large industry, and there is a large dry dock. There are also sawmills and ironworks. The city has over 150 factories, with products ranging from canned fish, biscuits, and soap to lumber, furniture, tents, paints, brass articles, and machinery.

VICTORIA CROSS. The most coveted and highly prized decoration of the British military and naval and air services. In shape it is a Maltese Cross, and is made of the metal from guns captured in the Crimean War, with the words *For Valour* inscribed beneath the royal crest. The ribbon is red. This decoration was instituted by Queen Victoria in 1856 to be granted for notable deeds of valour. It is sometimes bestowed posthumously.

The number awarded up to the outbreak of the World War was only 522. During the latter great conflict, many more were granted, yet the Victoria Cross was bestowed sparingly, that it might not be cheapened in the eyes of the nation.

VICTORIA FALLS. A waterfall in South Africa, discovered by Livingstone in 1855 and named by him in honour of England's queen. The falls are about midway in the course of the Zambezi River, in Rhodesia. The river, about a mile wide, approaches the falls at a gentle grade, but suddenly dashes over the edge of a deep chasm, striking the opposite wall with a deafening roar which can be heard for 20 miles. The height of the falls varies from 256 ft. at the right bank to 343 ft. in the centre, as compared with 158 ft., the height of Niagara Falls.

VICTORIA NYANZA, ni an' za. The largest lake in Africa, and the headwater of the River Nile.

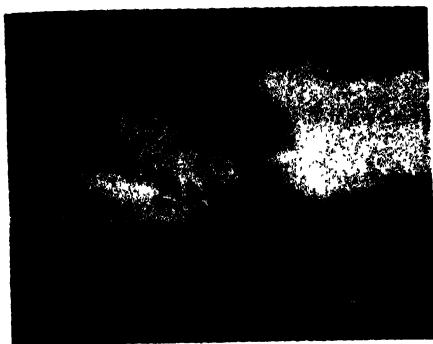
Its area is 26,000 sq. miles, being second in volume to Lake Superior among the fresh water lakes of the world. It lies partly in the territory of Tanganyika, partly in Kenya and partly in Uganda. Victoria Nyanza was discovered in 1858 by Speke, and named after the reigning English queen. *Nyanza* is the native name for lake.



A FISH CAUGHT IN LAKE
VICTORIA

Photo: Cherry Kearton

VICUNA, *vik koon'ya* An animal of the camel family, found at great elevations in the most desolate parts of the mountains of South America. Its habits are very similar to



CLOUDS OF FLIES ON LAKE VICTORIA
Photo: Cherry Kearton

those of the chamois of the Alps. The vicuña belongs to the same group as the llama, guanaco, and alpaca (all of which see). It subsists on grass, and is usually found in herds of from six to fifteen females, with one male as a guide and protector. The vicuña is about 2½ ft. high at the shoulder, and has a long, slender neck, protruding muzzle, and long, pointed ears. Its short brown wool gives this animal considerable economic value.

Scientific Name. The vicuña belongs to the family *Camelidae*. Its scientific name is *Lama vicuña*.

VIENNA, *ve en' a*, officially, *WIEN*, *veen*
Capital of the republic of Austria, fifth in

size among European municipalities, and until 1918, the capital and metropolis of the Austro-Hungarian Monarchy. With a population of 1,874,130, it has over one-quarter of the inhabitants of the entire republic. It lies on the right bank of the Danube, at the head of a beautiful plain between the Carpathians and Alps, and is 330 miles south-east of Berlin.

A series of inner fortifications were built around the original city, but in 1858-1860 they were demolished, and the site is now occupied by the Ringstrasse, a spacious boulevard, and the city's most famous thoroughfare. In this district are the imperial palaces, government buildings, and many other imposing edifices.

An arm of the Danube, known as the Danube Canal, intersects the city in a north-west-south-east line. A small stream, the Wien, flows into the canal. A number of suburbs lie beyond the Ringstrasse, and in 1706 they were surrounded by a rampart and fosse known as the *Lines*. In 1893 these fortifications were also destroyed, and a handsome boulevard, the *Gürtelstrasse*, was built.

Notable Buildings. A conspicuous object near the central part of the Inner City is the Cathedral of St. Stephen, one of the few medieval edifices of this essentially modern town. South-west of the church is a spacious area occupied by the structures of the imperial palace, or Hofburg. From the



THE DANUBE CANAL
An artificial arm of the river at Vienna.
Photo: Austrian State Travel Bureau



PART OF THE RINGSTRASSE, VIENNA, SHOWING THE FAMOUS BURGTHEATER

This is a State theatre devoted to the spoken drama, as distinct from opera, and to production of classical and modern plays

Photo: Austrian State Travel Bureau

thirteenth century to 1918, this great pile was the official residence of the Hapsburg Emperor. One of the handsomest of the buildings is the Imperial Library, which contains 1,200,000 volumes, many priceless manuscripts, and valuable art collections.

The Imperial Museums of Art and of Natural History are in the Italian Renaissance style. The Rathaus, or town hall, is an example of Gothic architecture, and exhibits a wonderful elaboration of ornamental detail.

The Court, or Hofburg, Theatre, another Renaissance structure, is on the inner side of the Ringstrasse, opposite the Rathaus.

Commerce and Industry. Vienna is the leading industrial and commercial centre of Austria, and is the focus of the railway lines in the republic. It lies at the point where railway routes from Leningrad, Berlin, Paris, and Rome intersect. The Danube Canal was converted into a great harbour by the construction of a lock at its entrance, and the city is therefore an important Danube port. There is great manufacturing activity in Vienna, especially in the field of artistic wares, clothing, textiles, and musical instruments.

History. The city of Vienna grew up on

the site of a Celtic settlement which the Romans seized and converted into a fortified camp early in the Christian Era. It was called by them *Vindobona*. The date of the adoption of the name Vienna is obscure, but the name is mentioned in a document of 1137. During the Crusades, the place became a prosperous trading centre. In the thirteenth century, the Hapsburg rulers of Austria made it their capital, and as the capital of the Dual Monarchy it acquired great prestige.

Known before the War as one of the most vital social, political, and economic centres of Europe, it has declined in importance since the fall of the Hapsburgs.

VIENNA, CONGRESS OF. A convention of all the Powers of Europe, in the winter of 1814-1815, following the fall of Napoleon. Metternich headed the Austrian delegation, Lord Castlereagh represented England, Alexander I came from Russia, Wilhelm von Humboldt was the dominant member of the Prussian delegation, and many other celebrated personalities made this convention a memorable one.

Their efforts were toward maintaining a balance of power. They joined Belgium and

Holland, countries of different language, customs, and history, thus causing a war in 1830. They gave Prussia the Rhine provinces, Austria most of Northern Italy, and Russia a wedge of Polish territory between Austria and Prussia; they took Norway from Denmark and gave it to Sweden, and assigned Swedish Pomerania to Prussia. The Bourbons were restored in Naples.

The first treaty was signed 9th June, 1815, and was subsequently ratified by the Powers. Although severely criticized, the work of the convention, in partitioning Europe, stood the test of time, yet by ignoring the racial frontiers in south-central Europe it created new problems which were left to be solved by the new partition following the World War.

VIKINGS, *vi' kingz*. See **NORTHMEN**.

VILLA, *vil' ya*, FRANCISCO, or PANCHITO (1877-1923). A Mexican bandit and revolutionist whose raids across the American border in 1916 brought the United States close to a state of warfare with Mexico. His real name was Doroteo Arango. He was treacherously murdered by former followers.



FRANCISCO VILLA
Photo Brown Bros

VILLA, *vil' ya*, FRANCISCO, or PANCHITO (1877-1923). A Mexican bandit and revolutionist whose raids across the American border in 1916 brought the United States close to a state of warfare with Mexico. His real name was Doroteo Arango. He was treacherously murdered by former followers.

VILLA FRANCA,
vil la fran' ka,
TITANY OF. See
NAPOLEON III.

VILLEINS. See
FEUDAL SYSTEM.

VILLON, *ve yo N'*, *ve lo N'*, FRANÇOIS (1431-about 1485). A French lyric poet, sometimes called "the vagabond poet," whose dissolute life and poetic brilliance combined to make him one of the most romantic figures of medieval France. He was born near Paris, and adopted the name of his foster father in place of his own, which was De Montcorbier. He was sentenced to banishment for having killed a priest in a street brawl, but the sentence was rescinded on the ground of self-defence. In 1457 he joined a gang of burglars, and was caught and sentenced to be hanged, but the sentence was commuted to banishment. He was released from jail in 1461 by Louis XI, which is the last that the world knows of his doings. Villon's work consisted mostly of ballads. His poems were published in Paris in 1489, and twenty-seven editions appeared before 1542. Other editions were printed as late as 1892.

VILNA. See **POLAND**.

VINCI, *vin' chi* LEONARDO DA, (1452-

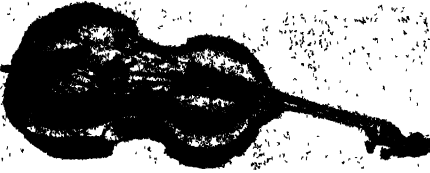
1519). The most universal genius of the Renaissance; not only one of the greatest painters of the age, he also made important contributions to most of the arts and sciences then known. The illegitimate son of Ser Piero, a notary of Vinci, he was born in the neighbouring village of Anchiano near Florence and, at the age of 14, was apprenticed to the studio of Verrocchio, the Florentine artist. Vasari, referring to him during this period, declared that he studied not one branch of art alone but all those of which drawing formed a part, and that, although only a mere youth, he had already put forward plans for canalizing the Arno from Florence to Pisa and had designed flour mills and water mills. When, in 1483, he was sent to Milan in the service of Ludovico il Moro, Duke of Milan, it was, characteristically enough, to his skill as a musician that he owed his appointment. Here, amid multifarious activities as architect, military engineer, and philosopher, he painted the world-famous "Last Supper," now in a sadly ruined condition. Another great work, an equestrian statue of Francesco, father of Ludovico il Moro, was destined to destruction at the hands of Gascon bowmen who used the clay model as a target when the French captured the city in 1499. In 1502, Leonardo, whose inventive genius had been found of great use during the siege of Milan, was called to Rome to under like similar duties on behalf of the Papal armies. He returned in 1506 to Milan to expend part of his inexhaustible energies in designing the irrigation schemes on which depends the wealth and fertility of the plain of Lombardy. His last years were spent in France, under the patronage of King Charles I, and he died at the Chateau de Cloux, near Amboise, on the 2nd of May, 1519. "La Gioconda" at the Louvre, Paris, and "The Virgin of the Rocks" at the National Gallery in London are among the best examples of his paintings.

VINE. As ordinarily used, this term refers to plants with flexible stems that require support. Some "vines" climb over walls, trellises, or other plants, and some creep along the ground. Tendrils and adhesive discs are among the devices the vines use to attach themselves to their supports. Vines are classified as *woody* and *herbaceous*, according to the structure of the stems.

VINEGAR. A sour liquid used as a condiment, and as an ingredient in the pickling of fruits and vegetables. It is the product of the fermentation of a dilute alcoholic liquid by certain bacteria, of which *Bacterium aceti* is the best-known. Wine is the original but not the only liquid used in its

manufacture. Cider vinegar has an apple-like odour and is brown or yellow. The distinguishing character of all vinegars is a sharp, biting taste, due to the presence of acetic acid. The amount varies from 4 to 8 per cent.

VIOL. A family of stringed instruments played with the bow, for some centuries contemporary with the violin family. Until the late seventeenth century the viols were



the better esteemed; they then became obsolete owing to a change in musical fashions (see Music), and the violin took the first place in musical art.

A serious misconception is to regard the Viols as the ancestors of the Violins (see VIOLIN). The viols are mentioned and distinctively described in a Spanish poem of the thirteenth century. From this and other hints, an Oriental origin, derived through the Moors, has been suspected. By the sixteenth century a fine contrapuntal literature is found in Spain, in the seventeenth,



WOOD VIOLETS
Photo: E. J. Hosking

the viols reached their apogee with the English consort music of from two to six parts. That music was written after the innovations of Monteverde (see MONTEVERDE), and in an age of stirrings in the musical art; but it retains, unlike the contemporary music of the Continent, the contrapuntal form. The result is a certain novel boldness in an outwardly traditional

style. Truly instrumental, this music cannot be transferred to violins without loss of character, and its rediscovery has led to a revival of the viols. English, French and German schools for the solo bass viol also exist, down to J. S. Bach, who wrote for that instrument three sonatas in his best vein.

VIOLET. The common name of a genus of flowering plants common to Europe, Asia, and America, blooming in early spring in shady dells, along mossy banks of streams, and even on barren gravel hillsides. Low clusters of glossy, heart-shaped leaves partly conceal the five-petalled blossoms, each on a slender flower stalk. Although certain varieties bear white and yellow blooms, the blue and purple are universal favourites. Among the latter are the common purple meadow, or hooded, species, the bird's-foot violet, whose blue and purple golden-hearted flowers often show twice a year, and the wood, March, or sweet violet. The dog violet is so called because it lacks fragrance. The related violas are favourite flowers in gardens.



HEARTSEASE OR WILD VIOLA
The species from which the garden violas are derived.
Photo: F. J. Hosking

Scientific Names. Violets belong to the family *Violaceae*. The meadow violet is *Viola cucullata*; the wood, *V. odorata*; the dog, *V. labradorica*.

VIOLIN, *vi o lin'*, pronounced also *vi' o lin*. A family of stringed musical instruments played with the bow, and the most important single group of instruments at the present day. Historically the violin is of great but uncertain age. It is not, as often thought, a descendant of the family of viols (see VIOL), but existed contemporaneously with them for several centuries at least. An earlier form of the violin type, the rebec, still common among the Arabs, was widespread over medieval Europe, like the early fiddle, it was regarded as a popular instrument as distinguished from the classical viols. By the sixteenth and seventeenth centuries the violin appears in

serious music contemporaneously with the still supreme viols. Before the turn of the seventeenth century the rôles were reversed and the viols were becoming obsolete.

The art of violin-making reached its highest degree of perfection in the sixteenth, seventeenth, and eighteenth centuries, especially in the city of Cremona, Italy. Cremona produced several of the world's most famous violin-makers, notably Antonio Stradivarius, Nicolo Amati, and Giuseppe Guarneri. Celebrated masters of violin-making also appeared in England, Germany, and France.

The full family of violins comprises (a) the violin (or treble) itself; (b) the viola (or alto), somewhat larger, but still played under the chin, and tuned a fifth lower than the violin; (c) the true tenor violin, an octave lower than the violin, and held between the knees; (d) the violoncello (or bass), an octave lower than the viola, and held between the knees. Five-part harmony was commoner than four-part in the sixteenth and seventeenth centuries; the extra part was given



(a) Scroll. (b) Keys. (c) Peg-box.
(d) Finger-board. (e) Sound holes
(f) Bridge. (g) Tail-piece.

to a second violin. In the eighteenth century the true tenor became obsolete for unknown reasons, and the quartet thus remaining consists of first and second violins, viola, and violoncello. (e) The double-bass (which see) supports the cello in orchestral music and only occasionally has a separate part.

VIOLONCELLO, *ve o lon chel' o*. See ABOVE.

VIPER. The name of a family of venomous snakes confined to the tropical and temperate regions of Europe, Asia, and Africa. Vipers are distinguished by a flat, triangular head, plainly differentiated from the neck, and by a catlike pupil of the eye. In most of the species, the top of the head is covered with small scales. The common viper, or adder, the only poisonous reptile found in Great Britain, is generally less than 2 ft. long, and is usually coloured brownish-yellow, with zigzag markings on its back and black, triangular spots on its sides. Its bite is seldom fatal, but usually causes pain and fever.

In America is found the family of *pit*

vipers, distinguished by a deep pit between the eye and the nostrils, which is connected with the brain by a well-developed nerve.



HORNED VIPER

This is the only snake that travels sideways.
Note the tracks in the sand.

Photo: Cherry Kearlson

Some observers believe that it is the organ of a sixth sense.

VIREO, *vir' re o*. Any one of a family of very small, insect-eating birds, keeping closely to foliage, and from their greenish colour commonly known as *greenlets*. They are found only in America, and are especially abundant in the tropics.

Scientific Name. The vireos constitute the family *Vireonidae*. The red-eyed is *Vireo olivaceus*.

VIRGIL. See VERGIL.

VIRGINAL. The name which appears at different times to have been applied to the spinet or harpsichord, though it more properly belongs to the spinet. The first mention we have of the instrument is in 1511. During the time of the Tudor and the first Stuart monarchs the virginal was very popular in England, and some of the finest English music was written for the virginal or spinet. Byrd was probably the outstanding composer. Much of the virginal music is collected in the Fitzwilliam Virginal book, Will. Forster's Virginal book, and others.

VIRGINIA. In Roman legend, the daughter of Lucius Virginius, a plebeian centurion. Appius Claudius, a decemvir, was attracted by her beauty, and ordered one of his clients, Marcus Claudius, to bring her before him as the client's slave. When Marcus swore that she was his property, Virginius pleaded for her release in vain, whereupon he stabbed her to death.

VIRGINIA. The northernmost State of the South Atlantic group of the United States. It was the earliest permanent English colony in America, and at one time the term *Virginia*, given by Sir Walter Raleigh to this colony in honour of Elizabeth, the "Virgin Queen," was applied to much of the southern coastal region.



STATE CAPITOL, VIRGINIA

Photo: Virginian State Chamber of Commerce

It has an area of 42,627 sq. miles, and a population of 2,421,851 in 1930.

Although the number and size of the cities and towns have recently increased, in 1920 over 70 per cent of the population still lived in rural communities. Richmond, the capital, is the largest city, with a population of 182,929 in 1930. Norfolk, Roanoke, Portsmouth, Lynchburg, Newport News, and Petersburg are other cities.

The land includes part of the great coastal plain of the United States, rising in the west to the Blue Ridge Mountains where Mount Rogers (5219 ft.) is the highest point.

The eastern part of the State is drained into the Atlantic and its great arm, Chesapeake Bay, by rivers which rise in the western mountains and cross the State in a mainly south-easterly direction.

The southern part of the state is drained by the Roanoke River, which flows south-east into North Carolina.

Agriculture and Industries. Owing to the mild climate, long summers, and abundant

rainfall, agriculture is the leading industry of the state. The tobacco plantations, which have been so important in Virginia's history, lie east of the Blue Ridge Mountains and west of the tidewater line. In the great valley, large crops of wheat, maize, and other cereals are grown.

Mining is rapidly becoming an important industry. Coal, iron, building stone, and salt are all found in abundance.

Tobacco products are first in importance of the manufactures. The textile industry has become second in importance, cotton, silk, and woollen mills, and, more recently, artificial silk or rayon plant produce merchandise of great value.

Government. The General Assembly consists of a Senate of forty members, and a House of Delegates of one hundred.

VIRGINIA CREEPER. A rambling, creeping plant of the grape family, native to America. The strong but slender tendrils have long branches ending in tiny adhesive discs. It is commonly used for covering the walls of houses. In the autumn, the Virginia



CHRIST CHURCH, ALEXANDRIA, VIRGINIA

George Washington attended services at this church, which was completed in 1773, and his funeral service was conducted here in 1799. Washington's pew is on the left.

Photo: U. & U.

creeper is strikingly beautiful, with its flaming foliage and bunches of dark-blue berries.

VIRGIN ISLANDS. (1) A group of islands in the West Indies, purchased from Denmark by the United States in 1917. The group, formerly known as the Danish West Indies, consists of three main islands—St. Thomas, St. Croix, and St. John—and a number of rocky islets. The islands have a combined area of 133 sq. miles. The population (chiefly negroes) is 22,000. The islands produce sugar, tobacco, tomatoes, and cattle, and are noted for their export of bay-rum and rum. St. Thomas has a fine harbour and is a coaling and oil-fuelling station.

The Virgin Islands were purchased by the United States for £5,000,000 in view of their strategic position in relation to trade routes via the Panama Canal. The islands were discovered by Columbus in 1494. Denmark made a settlement in them in 1672.

(2) The British Virgin Islands, numbering thirty, with a total area of 67 sq. miles, are included with the Leeward Islands. The islands are mountainous and not very fertile. Sugar and some vegetables are grown, but there is little or no export. The population in 1931 was 5360, mainly coloured.

VIRGIN MARY, THE. See **MARY,** THE VIRGIN.

VIRGO, THE VIRGIN. A zodiacal constellation, now mostly in the sign of Libra, also the sixth sign of the zodiac, into which the sun enters about 23rd August. In astronomy, the symbol is ♍, supposed to represent a wing.

The principal object in the constellation is Spica, a star of the first magnitude. Gamma Virginis is a fine double, with equal components. There is a great concentration of nebulae in this region.

VIRUS, *vi' rʌs*. A term applied in medicine to any poisonous substance which, when transmitted to a person, produces in his body a particular disease. It may be a specific germ (bacillus, bacterium), isolated and seen through the microscope, or an organism too small to be visible microscopically, and capable of passing through a filter with pores too fine to admit visible bacteria.

Such an ultra-micro-organism is called a *filter-passing virus*. But a virus is not necessarily a living organism.

VISA. See **PASSPORT**.

VISCOSE, *vis' kōs*, **PROCESS.** See **CELLULOSE**; **RAYON**.

VISCOUNT, *vi' kount*. An English title of nobility of the fourth degree, next below earl, and next above baron. The title was originally conferred upon the officer who acted as the earl's deputy, and it was first granted to John Beaumont in 1440. The title is now entirely honorary, and is not connected with an office. A viscount's wife is styled "Viscountess," and the children, both sons and daughters, are addressed as "Honourable." His eldest son bears, by courtesy, any second title his father may enjoy.

VISHNU, THE PRESERVER. The second god of the Hindu triad, the others being Brahma and Siva. In the Vedas he appears as a manifestation of the sun. In later times he was the god of the middle classes of India. In the human forms of Rama and Krishna he is worshipped by millions of Hindus. See **DOMINIONS AND INDIA VOLUME (India Religion)**.

VISIGOTHS, *viz' i goths* (Goths of the West). See **GOTHS**.

VISOR, *vi' zər*. The face-piece of the knightly helmet, usually a perforated piece of metal, hinged at both sides to move up and down, and which, when closed, permitted the wearer to see, but denied entrance to lance point or arrows.

When approaching the enemy with lance in rest or exposed to attack by arrows or cross bow bolts, the visor was kept closed, but as soon as lances were relinquished for close combat weapons, it was possible to open the visor, since the cross bars of the helmet would keep out a stroke of sword, battle axe, or mace.

The visor was usually constructed with a sharp point in front, so as to present the smallest possible surface as target to an opponent's lance.

The word is derived from *visière*, a French word meaning "shade or protection."



VIRGIN ISLANDS HARBOUR

The landlocked basin harbour of St. Thomas Island lost much of its importance with the passing of sail, but now its floating dry docks service steamers using the Panama Canal.

Photo: U. & U.

VISTULA, *vis' tū la*, RIVER. Its source is in the Carpathian Mountains, in the northern part of Czechoslovakia. It follows a circuitous course through Poland, touches the western boundary of East Prussia, crosses Danzig, and discharges by several branches into the Baltic Sea; the most easterly stream, the Nogat, discharges into the sound called Frisches Haff. The Danzig branch is the one principally used for navigation; lighter craft proceed as far as Cracow. Navigation is interrupted for about three months of the year, when the river is frozen.

The commercial importance of the Vistula is increased by canal connection with the Oder, the Dnieper, and the Niemen. The total length of the river is about 650 miles, and the area of its basin is about 74,000 sq. miles. The principal cities along its course are Cracow, Warsaw, Danzig, Thorn, and Marienburg.

VITAMINS, *vi' tū mīnz*. Certain organic substances which are found in foods in minute quantities, but which are indispensable to health and growth. Seven of these factors have been identified, though their exact chemical composition has not been determined. They have been named from the letters of the alphabet, in the order of discovery, and are as follows—

Vitamin A. This is a fat-soluble substance found in abundance in butter, cream, beef-fat, fish-liver oils, milk, egg-yolk; other sources include green vegetables and carrots, especially when raw, most fruits, whole-meal bread. Vitamin A is especially essential for growing children, and adults need it to build resistance to diseases.

Vitamin B. This is a water-soluble substance, which later research has shown to be a mixture of two vitamins, distinguished as B₁ and B₂. Lack of these causes the diseases known as *beri-beri* and *pellagra* respectively. Yeast is very rich in both B₁ and B₂; wheat-germ is richer in B₁ than B₂, as also is human milk; cow's milk is the reverse. Other good sources are meat, raw green vegetables, tomatoes. There is little or none of these vitamins in white flour, polished rice, and other refined cereals, fats, and sugar. Because they are water-soluble, vegetables cooked in water lose much of their vitamin content.

Vitamin C is essential because it prevents scurvy. This *antiscorbutic* vitamin is soluble in water, and is found in great abundance in raw cabbage, orange, grapefruit, and lemon juice, and in raw, cooked, and canned tomato. Tomatoes are a valuable source of Vitamin C, because cooking and tinning do not affect the vitamin in any way.

Vitamin D. This is a fat-soluble vitamin found in the same foods as A. Its special

function is to prevent rickets, for it aids in the formation of bones and teeth.

Cod- and halibut-liver oils, which are standard remedies for rickets, owe their efficacy to the presence of this vitamin. It can be produced by ultra-violet rays acting either directly on the tissues of the body or on certain foods such as milk and olive oil. This vitamin is particularly necessary for growing children.

Vitamin E. This is a fat-soluble substance that prevents sterility and is necessary for reproduction. The best sources are wheat-germ oil (contained in whole-meal bread) and lettuce; other sources are yellow maize, egg yolk, and cooked meat.

Vitamin K. This is a vitamin whose presence is essential for the normal clotting of the blood. It occurs in green vegetables, pig's liver, and some other foods. It was discovered in Germany in 1936, and has not yet been fully investigated.

The way to obtain vitamins is to eat the foods in which they occur naturally. There are standardized preparations, such as yeast extract and rayed oils, that are valuable for curative purposes, but these should not be used except in cases of known deficiency.

VITELLIUS. See OTHO, MARCUS SALVIUS.

VITRIOL, *vit' ri ol*. OIL OF. See SULPHURIC ACID.

VIVANDIÈRE, *ve' vōN de air'*. A female sutler or camp follower, especially in the French army. Female camp-followers have been discontinued in the British Army for many years, but were allowed in French regiments up to the World War; their duties were to manage the canteen of the regiment, to which they were attached, but they frequently added to those duties the voluntary supply of water to combatants as well as wounded during battle. The *vivandières* also performed rough-and-ready "first aid" duties. They enjoyed the sole right to sell spirits or comforts to the regiment when on the march.

The word is derived from an Italian word, *vivanda*, meaning "food," and the French *vivandier*, meaning "a sutler."

VIVISECTION, *viu' sēk' sh'n*. A term meaning, literally, "the cutting of the living." It is applied to the practice of operating upon living animals for the purpose of studying facts of interest to the physiologist. The term is intended to include all scientific experiment conducted on animals, such as inoculation and the administration of poison.

The discovery of the anti-toxin for the prevention and cure of diphtheria, of the anaesthetic properties of ether and chloroform, the knowledge that trichinosis comes from eating under-cooked infected pork, that rats are carriers of bubonic plague, and that

malaria and yellow fever are spread by mosquitoes, are some of the major contributions made by this type of research. The animals operated on are placed under the effects of an anaesthetic, and, so far as possible, the investigations are made while the animal is unconscious. In spite of the beneficial results obtained through vivisection it is objected to by many owing to the unavoidable suffering entailed when an animal is inoculated with disease germs.

VIZIER, *viz zeer'*, OR **WAZIR**. A title in Mohammedan countries of the chief minister.

VLADIVOSTOK, *vlad' e vos lawk*. A seaport on the Sea of Japan in the Far Eastern Region of the U.S.S.R., with a population of 190,000 (1933). It was founded by Russia in 1860 as a military port and was originally a wooden town. Since becoming the terminus of the Trans-Siberian Railway in 1904 it has grown rapidly, and is an important seaport and naval base. The harbour is normally frozen for three months from the middle of December.

VOCAL CORDS. See **LARYNX**.

VODKA. An intoxicating drink, for many centuries the national spirituous beverage of Russia.

Vodka may be designated as Russian brandy. It is made from potatoes or maize, with green rye malt, or from barley and oats mixed with rye; also from potatoes and molasses. Its alcoholic content, as it comes from the still, may be as high as 90 to 96 per cent, but dilution reduces it to 40 or 60 per cent alcohol before it is retailed.

VOICE, *vois*. That possession of human beings by which they express their thoughts aloud. The voice mechanism might well be compared to an organ, with lungs for bellows, tongue and lips for stops; throat, mouth, and nasal cavities for sounding boards; and the vocal cords for reeds. These vocal cords, which constitute the essential feature in voice production, are two small bands of elastic tissue in the larynx, or voice box, one on each side of the windpipe. By an arrangement of muscles, they can be stretched out or made to relax. When one is breathing ordinarily they are relaxed, and have between them a V-shaped opening; but when air from the lungs is driven into the larynx for sound production, the cords stretch and are thrown into vibration, and the opening is narrowed. The more tightly they are stretched, the higher are the resulting tones. A deep, rumbling sound is made by relaxed cords. It is continued stretching of these cords that tires the voice.

VOICE. In grammar, see **VERB**.

VOILE. A light-weight, open-meshed fabric made from cotton, wool, or silk, and so called from the French word meaning *veil*,

for the material is used extensively for veils and habits of nuns. The weave is similar to that of calico, although the yarns in both the warp and weft are more tightly twisted for the voile. The fabric is dyed or printed in the piece. Cotton voile is usually made in 36 in. or 40 in. widths, while wool voile may be 42 in. or 50 in. wide.

VOLAPÜK, *vol a pük'*. The name given by Johann Martin Schleyer to a language which he invented, and which he first made public in 1879. It was intended to be a universal speech, as its name, derived from Volapük equivalents of the English words *world* and *speak*, declares, and its words or roots were chosen from most of the languages of Europe. About 40 per cent of its vocabulary was based on English, and the rest on Latin and the Romance languages. The borrowed English words, however, were so altered that they look no more familiar to an Englishman than to a German or a Frenchman. In its structure, Volapük is much more closely allied to German than to any other language.

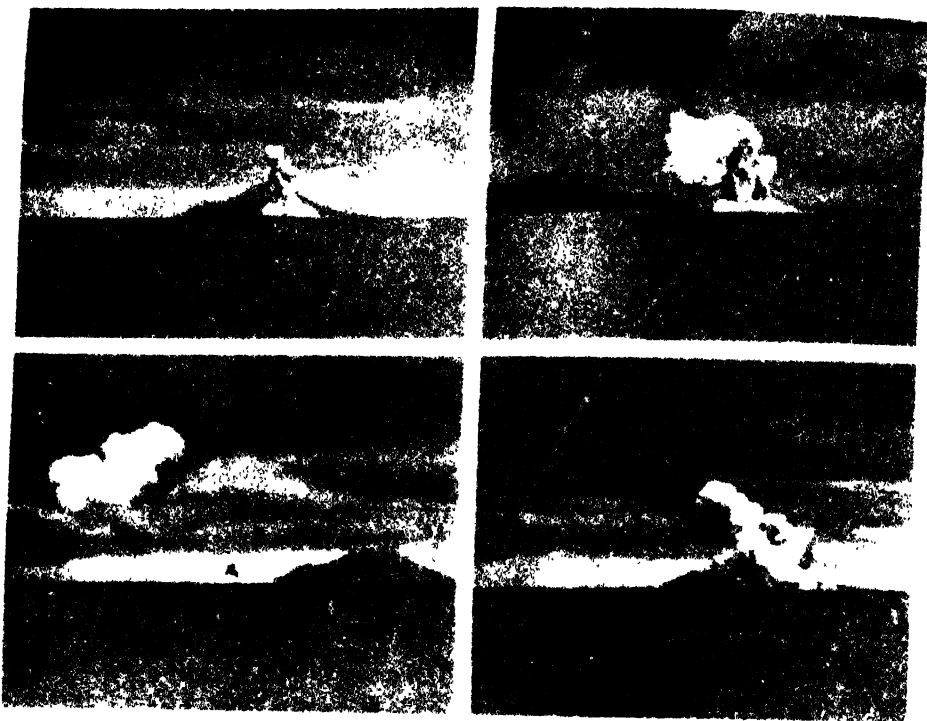
Volapük was the first artificial language to gain any measure of practical success or any considerable popularity. One nation after another took it up, societies were established all over the civilized world, and within ten years after its publication it had over a million students.

VOLCANO, *vol kay' no*. The term usually applied to a mountain from whose summit or sides, or both, steam, solid fragments, and molten rock (lava) are thrown out. The name comes from the Latin word *Vulcan*, the name of the Roman god of the fiery elements, and was originally applied to Mount Etna and some of the Lipari Islands, which were supposed to be the seats of Vulcan. The outflowing lava together with the ashes form a cone around the vent. The cone grows higher and higher as the matter continues to flow, and in time a mountain, with the vent or chimney extending to the summit, is formed.

The following are the chief causes of eruptions—

(1) *Pressure*. The crust of the earth is unstable, and the movements cause great pressure over certain areas. This pressure, and the friction caused by the movement of the rocks upon each other, are sufficient to create a temperature that will melt any kind of rock. In this way, pools of molten rock are formed beneath the surface. The molten matter is forced into the adjoining crevices, and occasionally finds its way to the surface and flows out as lava.

(2) *Steam*. Steam is by far the most powerful cause of volcanic eruptions. We read now and then of the destruction caused



SUBMARINE VOLCANIC ERUPTION

Four remarkable photographs of an eruption which formed a new island in Sunda Strait, between Java and Sumatra.

Photos U. S. C.

by the explosion of a steam boiler. But if we multiply the force exerted by the boiler by a million, we will not have a force as great as that operating in the explosion of a great volcano. Water coming in contact with molten rock is instantly changed to steam having a higher temperature than it is possible to reach in a steam boiler. As the steam continues to form, the pressure increases until it is sufficient to burst the walls of rock by which it is confined, and the explosion occurs with a force that grinds most of the rock to powder, which forms the so-called volcanic ash that often falls over wide areas.

Distribution of Volcanoes. Volcanoes occur in lines of weakness in the earth's crust and so are associated with areas of geologically recent folding and faulting, such as the Andes, Central America, the new Hebrides, Java, Sumatra, Japan, and the Mediterranean. The whole Pacific is ringed with volcanoes, active and dormant.

In the Antarctic are several volcanoes including Mt. Erebus (13,000 ft.)

VOLE. An English name for several species of small rodents belonging to the rat

family. In Britain the *water vole* is sometimes known as the water rat, and the *field vole* as the short-tailed field-mouse. Voles inhabit the temperate zones of both hemispheres, and can be distinguished from the other members of the rat family particularly by their blunt nose and shorter ears, tail, and legs. Water voles are about the size of the brown rat. In swimming, they use only the hind legs; in spite of their water habits, they do not have webbed feet. Their fur is dark brown or black. Field voles have stumpy tails and thick bodies, and are about the size of mice. Their fur is a greyish-tan.

Scientific Names. Voles belong to the family Muridae. The water vole is *Microtus amphibius*, the field vole, *M. agrestis*.

VOLGA REPUBLIC. An autonomous republic of U.S.S.R. lying, as the name implies, along the Volga, about 300 to 500 miles from its mouth. The population is largely of German descent from settlers in the eighteenth and nineteenth centuries. The 9600 square miles that comprise the area of the republic are fertile; wheat and tobacco grow well. The population is about 500,000; the capital is Engels (population 35,000).



SNOW-CAPPED MOUNT ELINA FROM THE BAY OF CALIFORNIA

VOLGA, RIVER. The longest waterway in Europe, its course being entirely within Russia. With its tributaries, it furnishes more than 20,000 miles of navigable waterway to a region in which live 50,000,000 people. The Volga itself is about 2300 miles long; two of its branches, the Oka and the Kama, are each longer than any other European river, except the Danube. Rising in the Valdai Hills, 200 miles south-east of Leningrad, the Volga flows south-east and empties into the Caspian Sea, 86 ft. below sea-level. The Volga has on its banks Saratov, a city of some 327,000 people, and six other cities, including Stalingrad, Astrakhan, and Gorki (Nizhni-Novgorod), each with a population of over 100,000. It is connected by canal with Leningrad.

VOLT. This is the electromotive force which will drive a current of one ampere through a resistance of one ohm. The volt is the unit of pressure, the ampere the unit of rate of flow. Voltage may be defined as the push that moves or tends to move a current through a conductor. One volt is practically the electromotive force of a simple voltaic cell. A common dry cell has a voltage of about 1.5. The instrument used to measure voltage is called the *voltmeter*.

VOLTA, vol' ta, ALESSANDRO (1745-1827). An Italian scientist, well known for his researches and discoveries in the field of electricity. His name is perpetuated in such terms as *volt*, the unit of electromotive force, *voltaic pile*, and *voltaic battery*. In 1744 he was appointed professor of physics in the royal school at Como, and five years later became professor of natural philosophy in the University of Pavia. He discovered the electric decomposition of water, and developed the theory of current electricity along physical lines.

VOLTAIC CELL. See **ELECTRIC BATTERY**.
VOLTAIRE, FRANÇOIS MARIE AROUET DE (1694-1778). A French philosopher, historian, and author, born in Paris. His real name was François Marie Arouet.

His career as a writer began with the production of *Oedipe*, a tragedy, which brought him fame as a dramatist. In 1724 his epic poem, *La Henriade*, appeared, in which he made an eloquent plea for religious toleration. Various troubles, culminating in a quarrel with the Chevalier de Rohan, led to imprisonment in the Bastille, followed by his removal to England. At this time (1726) he had written also the plays *Artémire*, *Mariamne*, and *L'Indiscret*.

Voltaire's stay in England, of about three years, exercised a great influence on his career. His *Lettres philosophiques*, written during his exile in England, is one of his masterpieces. Among the works which he

produced in the next few years are the tragedies *Brutus*, *Zaire*, and *Sémiramis*; the *History of Charles XII, King of Sweden*; and the revolutionary *Lettres Concerning the English Nation*.

In 1750 Frederick II of Prussia offered him the post of Court Chamberlain, and Voltaire went to Potsdam. Three years later he quarrelled with Frederick, and leaving Potsdam in 1753 he settled at Ferney on the shores of Lake Geneva.

He wrote freely, chiefly short pamphlets attacking religious fanaticism and intolerance, and in defence of the sovereignty of reason. During these years he also contributed to the *Encyclopédie*. The romance *Candide* and the tragedies *Tancrède* and *Irène* belong to this period.

Voltaire wrote copiously as a dramatist, historian, and philosopher. He is remembered to-day chiefly as a brilliantly witty and vigorous writer in defence of reason and intellectual liberty.

His atheism has been exaggerated since his death, he attacked orthodoxy, rather than Christianity, and a careful study of his writings does not warrant the broad application of atheist to his name.

VOLTMETER. This is the device used to measure the difference of potential between two points in an electric circuit. The voltmeter for direct current is usually a high-resistance galvanometer that registers volts directly on the scale.

VOLUNTEERS. Those citizens who offer their services in the naval, military or air services of government or country. All British fighting services are recruited by voluntary enlistment in time of peace, but volunteers give their services in peace time without remuneration and once often supplied their own arms. The system originated in England, the oldest volunteer organization being the Honourable Artillery Company of London, which received its charter of incorporation in 1537 from Henry VIII, but the main movement did not start until the middle of the nineteenth century, when counties, cities, universities and public schools formed volunteer corps of all arms. The outbreak of the South African war gave great stimulus to the Volunteers; companies of county and city volunteer corps served with distinction



VOLTAIRE
Photo Brown Jr

alongside their regular comrades, and new corps—such as the City Imperial Volunteers—were raised for service as complete units.

In 1902, a Royal Naval Volunteer Reserve was formed, with divisions in London, Sussex, Tyne, Mersey, Clyde, Severn, East Scottish, and Ulster areas.

In 1907, the county and city volunteer corps were transferred to the new Territorial Force and, together with the Yeomanry, given modern equipment and organized into divisions and mounted divisions, the university and public school contingents becoming officers' training corps. See **TERRITORIAL ARMY**.

In the World War voluntary enlistment was retained for nearly two years; in May, 1916, when the Military Conscription Act was passed, over 5,000,000 had enlisted voluntarily since the outbreak of the war.

Australia, Canada, New Zealand, South Africa, India and West Indies responded most generously with volunteers.

Ireland, excluded from the British Conscription Act, sent thousands to the front, besides being largely represented in the British Regular Army.

The Honourable Artillery Company has occupied its present quarters since 1641, and its armoury is open to American soldiers and sailors, since four of its members—Duncan, Keane, Sedgwick, and Spencer—who emigrated to New England in the seventeenth century, founded in 1638 the *Ancient and Honourable Artillery Company of Boston*—the senior volunteer corps in the United States. See **CONSCRIPTION**; **WORLD WAR**.

VOMITING. The ejection of food and other matter from the stomach through the mouth. The act is brought about by spasmodic muscular contractions of the walls of the stomach. Such contraction is called *reverse peristalsis*. Vomiting is generally preceded by a sensation of nausea, and it is often the result of overloading the stomach or of eating indigestible food. Foods or drugs which poison the system are often ejected through the automatic reaction of the stomach to these harmful substances.

In vomiting the lower end of the stomach remains tightly closed.

VORARLBERG. A province of the Austro-Hungarian Monarchy before 1918; now a province of the republic of Austria. See **AUSTRIA**.

VORONOFF, SERGE (born 1866). A celebrated Russian surgeon and physiologist; was educated in Paris for the medical profession. His early appointments included those of chief surgeon at the Russian Hospital. During the World War he was director of the biological laboratory of the *Ecoles des Hautes Etudes*, and later director of experimental surgery at the *Station Physiologique*

du Collège de France. He developed and extended the application of the theory of Brown-Sequard that gland secretions of animals and mankind are similar. He used animal secretions to supplement deficiencies in human beings. Voronoff went further and grafted healthy animal glands on humans. His many treatises on the subject of his theories and practice include *The Study of Old Age and My Method of Rejuvenation*, *Thyroid Grafting*, and *Ovarian Grafting*.

VORTICELLA, *vor-ti-sel'-a*. A genus of Infusoria, the highest division of one-celled animals. It includes minute aquatic animals having a bell-shaped body which is borne on a slender stalk. This stem is attached to a rock, leaf, or weed in the water. The top of



THE FORGE OF VULCAN

From a painting by Velasquez now in the Prado Gallery

Photo Anderson

the inverted "bell" which forms the body of the organism is fringed with cilia. The stem can be contracted into a close spiral, whence the name.

VOSGES, *vozhs*, **MOUNTAINS**. A mountain range of Central Europe which extends north-north-east along the western side of the Rhine Valley for about 150 miles, and marks the frontier between the French provinces of Vosges and Alsace. The mountains are composed chiefly of granite and red sandstone, and contain copper, lead, silver, coal, and rock salt.

VOTE AND VOTING. See **FRANCHISE**, **ELECTIONS**.

VOWEL. An open, resonant sound made by the voice in speaking. It is the openness of vowels that distinguishes them from consonants, which are formed with the organs of speech more or less closed. A vowel may itself constitute a syllable, or it may be joined with one or more consonants to produce one. In English, the vowel sounds are represented by the letters *a*, *e*, *i*, *o*, *u*, and sometimes *w* and *y*, but each letter does duty for several sounds

VOYVODINA, *voi vo de' nah*. See YUGOSLAVIA.

VULCAN, *vul' kan*. In Roman mythology, the god of fire and the patron of the blacksmith and the artist in metal. His Greek counterpart was Hephaestus. Vulcan, who was the son of Jupiter and Juno, was born lame, and so shocked was his mother that she threw him from Olympus; but he was saved and brought up by the nymphs and Nereids, in a cave beneath the ocean.

Another legend to account for his lameness states that, in one of the quarrels between Jupiter and Juno, the latter was suspended between heaven and earth, with anvils hanging to her person. Vulcan saw her there and attempted to rescue her, but was detected in the attempt. This so incensed Jupiter that he kicked the young god out of heaven; for a whole day Vulcan fell, finally landing on the island of Lemnos. He was skilful in the use of metals, and forged the thunder bolts of Jupiter. Many of the objects that he made he was able to endow with life. He made brass-throated, fire-breathing bulls, gold and silver dogs, and for himself golden maidens, endowed with reason and speech.

VULCANIZING. See RUBBER AND RUBBER MANUFACTURE.

VULGATE. A Latin translation of the Bible, completed in A.D. 405 by Saint Jerome. The term means "commonly received translation." Pope Sixtus V superintended the revision of the Vulgate in 1587, but after his death, in 1590, many errors were found in the work. Pope Clement VIII ordered further revisions in 1592, which were followed by editions in 1592, 1593, and 1598, the last of which became the official testament for use in the Roman Catholic Church.



VULTURES

A jackal can be seen in the left foreground.

Photo Cherry Kearton

376—(C.236)²



VULTURE

Photo Smuck African Railways



TURKEY BUZZARD

Photo Visual Education Service

The main differences between the Vulgate and the English versions of the Bible are in the order of the books, the inclusion or omission of certain books, and in chapter divisions. The English translation of the Vulgate is called the Douai, or Douay, Bible, having been named from the town of Douai, in which it was published. Another revision of the Vulgate is in course of preparation. See BIBLE.

VULTURE. Large birds-of-prey whose food consists chiefly of carrion—dead and decomposing animal material. They are widely distributed in the tropical and temperate regions of the Old and New World. On account of their value as scavengers they are generally protected. They are attracted to their food more by an extraordinary keenness of sight than by a sense of smell. Vultures are without feathers on the head

and neck, and, sometimes, the chest, a baldness, which gives them an ugly appearance.

The Great or Giant Condor which lives in the high rocky places of the Andes is second only to the albatross in size, having a maximum wing-span of about 10 ft. The Condor of California is much smaller and belongs to a different genus. The King Vulture is a shyer species inhabiting wooded areas in Central and South America. It is about 2 ft. in length. Other American species are the Black Vulture and the Turkey Vulture.

In the Old World the Griffon Vulture is found from Southern Europe to Turkistan, and from Central Russia to North Africa. It has occurred as an accidental visitor in

Britain. This vulture breeds in colonies on precipitous mountain ledges.

The Aasvogel is a common South African vulture. Other species are the African and Indian white-backed Vultures, the Sociable Vulture, found in Africa, and the Egyptian Vulture. The last-named, also known as Pharaoh's Hen, has been known to occur in Britain. Unlike the Griffon it did not seem to have any sacred significance in ancient Egypt, though its figure is occasionally found on monuments.

Scientific Names. Giant condor, *Vultur gryphus*; Californian condor, *Gymnogyps californianus*; king vulture, *Sarcoramphus papa*; griffon vulture, *Gyps fulvus*; Egyptian vulture, *Neophron percipiter*.

THE WORLD BOOK

W w

The twenty-third letter of the English alphabet. Neither the Phoenician nor the Greek alphabet possessed the letter. In early Latin the sound represented by *W* was indicated by a *u* or *v*. When *u* became established as a vowel and *v* acquired its present force, a new character was formed by the joining of two *u*'s or two *v*'s. Italian and French only use *u* in borrowed

words. In English *w* is one of the semivowels. It forms part of diphthongs, as in *now*, *maw*, *new*, and is sometimes used after other vowels without changing their sound, as in *borrow*. As a consonant, it has but one sound, but is frequently silent before *r*, as in *wreath*, or after *s*, as in *sword*.

WADAI, *wah' di*. A territory south of the Sahara and west of the Anglo-Egyptian Sudan, formerly an independent Mohammedan sultanate. It was declared a French Protectorate in 1903 and conquered by 1911. It is now part of French Equatorial Africa. The total area is about 170,000 sq miles, and the population, semi-civilized, is about 1,000,000, comprising chiefly negro tribes, Arabs, and half-castes, dominated by a race of Mabas, of Nubian origin.

The surface is principally desert or plain, where ostriches abound, but there are many fertile oases and some large forests where gazelle and elephant are found in large numbers. The capital is Abeshr, a town of two-story, mud-brick buildings (population 5000), whence desert caravan routes cross the Sahara to Benghazi and Khartoum. Maize and cotton are the principal products of the land.

WADER. A rather vague name, though usually clear enough to the field naturalist, for certain more or less related birds which are found associated with water. They have long pointed bills and long legs. These birds belong to the large scientific group *Charadriiformes*, and include such birds as sandpipers, dunlin, snipe, knot, sanderling, redshank, and curlew.

WAFD, *wahfd*. The Nationalist political party in Egypt. See EGYPT.

WAGNER, *wahg' ner*, **WILHELM RICHARD** (1813-1883). A German musician, poet, and essayist, best known as an operatic composer. Wagner was a native of Leipzig, and is said to have shown marked application and talent at an early age.

In 1832 he composed a symphony, in 1833 his first opera, *Die Feen*, and the same year, at the age of 20, he became a professional musical conductor. His first notable success was the opera *Rienzi*, which, after being rejected in Paris, was received with warm favour in Dresden in 1842.

The success of *Rienzi* encouraged the composer to submit his *Flying Dutchman* to the Dresden public in 1843. Appointed chief director of music at the Dresden Theatre, he continued to develop the ideas which led to a revolution in operatic form. *Tannhäuser* was produced in 1845 and coldly received, for the public taste still asked for music modelled on Italian melodies. Wagner chose the old, tragic legends of Germany and composed scores in an appropriately heroic vein.

He was involved in a political rising in 1848 and had to flee. He went first to Paris and then to Zürich, Switzerland, where he remained in exile until 1859. During this period, most of his prose works were published. In 1850 Liszt brought out Wagner's newly completed *Lohengrin* at Weimar, and



RICHARD WAGNER
Photo. German State Railways

it was so successful that at Liszt's request, the exile hastened to begin work on another musical setting of a great legend. He was permitted to return to Germany in 1861, and two years later completed the *Ring of the Nibelung*.

Between 1865 and 1867, he produced *Tristan und Isolde* and *Die Meistersinger*. A theatre specially designed to allow a full presentation of *The Ring*, with its revolutionary scenic effects, was begun at Bayreuth in 1872 and completed in 1876. In August of the same year, the first part of *The Ring*, entitled *Das Rheingold*, was played, and was soon followed by *Die Walküre*, *Siegfried*, and *Götterdämmerung*.

Innovations noted at the Bayreuth performances included magnificent scenery, previously unknown in opera, a hidden orchestra thus diverting interest from the players to the actors, and the "melos" or endless melody which united every scene into a harmonious whole. In 1882 he completed *Parsifal*, founded on the legend of the Holy Grail. After a number of successful performances his health suddenly broke, and he died in Venice of heart failure, on 13th February, 1883. His second wife, Cosima, daughter of Liszt, to whom he was married in 1870, carried on the Wagner tradition at Bayreuth. She died in 1930, aged 92.

Wagner's music has been severely criticized; vulgarity and self-conscious bombast have been attributed to it, but Wagner's paramount influence on modern opera cannot be gainsaid. He is important as a poet and dramatist as well as composer.

WAGTAIL. The popular name for a small, insect-eating song-bird, of which many species are found throughout the Old World, in



PIED WAGTAIL
Photo E. J. Hocking

Asia, and in North-West America. It may be recognized by various quick movements, and its habit of suddenly standing still and wagging its tail, or of running swiftly while it jerks its tail up and down.

Scientific Name. The wagtails belong to the family *Motacillidae*.

WAHHABIS, *wah hah' bees*. The Moham-medan sect of Ikhwan, or the Brothers, founded two hundred and fifty years ago by Wahab, after whom they are named was revived about 1900 by Abdul Aziz who sought to re-establish his dynasty's authority. The strictest sect in Islam, they base their beliefs on the Koran alone, rejecting any teaching not found there. They deny, for instance, any need for a Caliphate, as that office is not provided for in the book. They have checked inter-tribal wars among themselves but are ruthless when engaged in a *jihad*, or holy war, against anyone not a Wahhabi. Under Ibn Saud, King of Nedj, they have conquered most of Arabia.

WAILING WALL. An ancient wall in Jerusalem used as a place of lamentation by the Jews. This custom was questioned first in 1912, and in 1929 was the cause of riots between the Arabs and the Jews. A commission appointed by the British Government in 1931 adjudged the rights of Moslems and Jews at the Wailing Wall. See PALESTINE.

WAITS. In the fourteenth and fifteenth centuries the waits were watchmen who sounded horns and sometimes played tunes to notify the evening hours. Their duties included attendance at the installation of Knights of the Bath. Other waits in the Middle Ages had to take part in the annual procession of the Lord Mayor of London through the streets of the metropolis. Until the year 1829 the street watchmen (in that year superseded by policemen) were called waits. Their practice was to sing carols at Christmastide and to call upon citizens on Boxing Day for gratuities, hence we have the modern meaning of waits, i.e. those who play or sing carols in the streets at Christmastide for alms, either for themselves or for a charity.

WAKE. The custom of keeping watch and vigil over the dead before burial. In Britain, the custom of "waking" a corpse appears to have existed before the Christian Era, and was probably Celtic. The Anglo-Saxons called the custom *lichwake*, from *lic*, a corpse. This name was corrupted later into *lykewake*. The body was often placed under the table on which was liquor for the watchers, and such wakes tended to become drinking orgies. After the Reformation, the custom became obsolete in England, but survived in Ireland, though the practice is now on the wane.

WAKEFIELD. This cathedral city and County Borough has a population of 59,122 (1931), and is the capital of the West Riding of Yorkshire. It is on the main lines of the L.M.S.R. and L.N.E.R. There is also an excellent canal service provided by the Aire



WAKEFIELD CATHEDRAL
Photo Taylor

and Calder and Calder and Hebble Navigations. Woollen textile goods have been produced in Wakefield for many centuries, and knitting yarns and high and medium grade cloths are still important industries. There are also engineering industries of a varied



LORD WAKEFIELD
Photo: Central

WAKEFIELD OF HYTHE, CHARLES CHEERS, 1ST Viscount (born 1859). He was

character, as well as printing works, chemical works, and cocoa matting mills. Coal is mined in large quantities a few miles from the centre of the city.

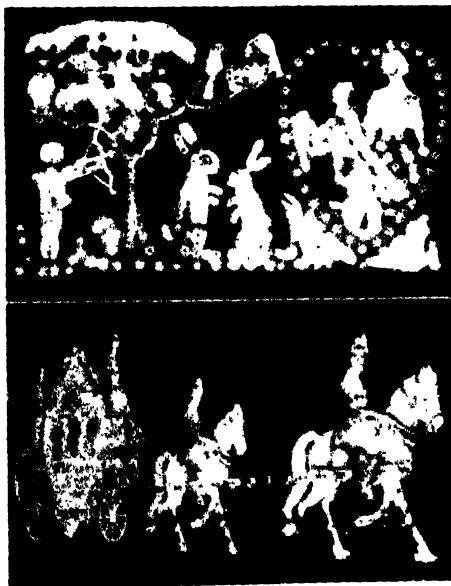
Wakefield was in existence at the time of the Roman occupation of Britain. It has been part of a royal demesne, and in the Domesday Book it was designated *Wachefeld*. It was created a city in 1888 and a county borough in 1915.

educated at the Liverpool Institute. He is Governing Director of C. C. Wakefield & Co., Ltd., Oil Manufacturers, etc.; Chairman of the North British & Mercantile Insurance Co.; President of the British Aviation Insurance Co., Ltd.; Alderman (Lord Mayor 1915-16) of the City of London. His achievements, occupations, benevolences, and work for the welfare of all and the progress of British industry and science, with particular regard to aviation, have been, and continue to be, remarkable.

WAKE ROBIN. See TRILLIUM.

WAKES. In Lancashire, and in parts of Yorkshire, the "wake" is the holiday event of the year. In mills, factories, and offices, weekly sums are paid in for distribution shortly before the summer holiday period. There is early origin of "wake" observances. In earlier days in England, a wake was an annual parish celebration of the dedication of a church, a feature of which was the reading of prayers on the preceding evening, and the singing of hymns through the night. The festival afterwards degenerated into a street fair, often lasting several days and marked with drinking and dancing.

WALCHEREN, wahl ker' ren, EXPEDITION, THE. In 1809 Lord Castlereagh sent a force to attack Flushing, on Walcheren I., to aid Austria by distracting France. The commanders, Lords Chatham and Strachan, quarrelled and the troops died of fever. The failure led to a duel between Castlereagh



WAKE WEEK ILLUMINATIONS AT BLACKPOOL
Photos: Fox

and Canning, who preferred a Peninsular expedition, and to their resignations.

WALDEN'SES. Name given to a Christian sect founded in the Middle Ages, whose members were followers of Peter Waldo, a wealthy merchant of Lyons, France. In 1176 he gave his money to the poor and began a life of poverty and devotion. The Waldenses believed that men should interpret the Bible in their own way, that religious works should be translated into and preached in dialects and tongues of the common people, and that any layman might preach. They were subjected to severe persecution, and in 1184 were excommunicated by Pope Lucius III; but they grew in number, and the sect persisted until the dawn of religious toleration. To-day, there are over 13,000 Waldenses scattered in half-a-dozen countries.

WALES. One of the political divisions of Great Britain, it has an area of 7466 sq. miles. The English county of Monmouth, with an area of 546 sq. miles, which formed part of Wales until 1535, is included with Wales for many purposes and is largely inhabited by Welsh. The greater part of Wales is a rugged plateau of ancient rocks rising into several well-marked mountain areas of which the most notable are the Snowden Range in the north-west with the conspicuous summit of Snowdon (3560 ft.). Carnedd Llewelyn (3484 ft.), and Carnedd Dafydd (3430 ft.); the Berwyn Range in the north-east with Cader Idris (2927 ft.); the Plynlimon Range in Central Wales with Plynlimon (2469 ft.); and the Brecon Beacons in the south-east (2900 ft.). In the north-west the detached part forming the Isle of Anglesey (276 sq. miles) is low-lying, and a strip of lowland fringes most coasts, but the chief lowland area is in the south where the rocks are of a newer formation. Many short rivers drain from the mountains in all directions, and the Severn and its tributaries flowing eastward have cut deep valleys in the uplands which allow intercourse from the east, while on the other hand the disposition of the relief tends to impede north and south communications and helps to separate North Wales from South Wales. Many mountain lakes add greatly to the scenic beauties of Wales. Others have been made for water supplies to various English towns. Thus, Birmingham gets water from Lakes Elan and Claerwen in the Wye Valley, and Liverpool from Lake Vyrnwy.

The climate is cool and rainy with an annual fall of 30 in. to 40 in. in the lowlands and 60 in. to 100 in. or even more in the mountainous interior. Strong winds are frequent. Most of the uplands are covered

with heath, and where drainage is poor, bogs and marshes occur. Oak, elm, and ash grow well at lower elevations if sheltered from strong winds. Larch is frequently grown.

Resources and Industries. Exposure, cool climate, heavy rain and indifferent soil do not encourage agriculture except in sheltered areas, and only one-eighth of the country is arable land. Most of the cultivated land is under grass and great numbers of sheep are grazed both for wool and the famous Welsh mutton. In the south and around the towns generally there are many dairy cattle, but in Anglesey and other areas the cattle are bred for beef. Pigs and poultry are also important. On the arable land oats are the chief



CONWAY HARBOUR, NORTH WALES
Photo - George Long

crop with some barley and very little wheat. Many cereal crops are used for feeding livestock. There are three coalfields. In the north-west the small Flintshire coalfield has little more than local importance, Ruabon is the chief mining town. The Pembroke-shire coalfield is little worked and is really a detached part of the great South Wales coalfield which normally produces about one-fifth of the entire coal output of Great Britain. It covers about 1000 sq. miles and has some 400 pits, but in recent years the fall in the demand for export coal, the principal activity of this coalfield, has caused serious unemployment and distress. This was one of the later coalfields of great Britain to be developed because of the lack of labour and distance from centres of demand, but its abundance of steam coal and anthracite led to a rapid growth of interest in the era of steamships, while the occurrence of local iron and other metallic ores led to the rise of metallurgical industries. The latter are now fed chiefly by imported ores. The growing use of oil fuel has been a blow to South Wales. Cardiff, Penarth, Newport (in Monmouth), Barry, Llanelly, and Swansea are coal exporting towns.



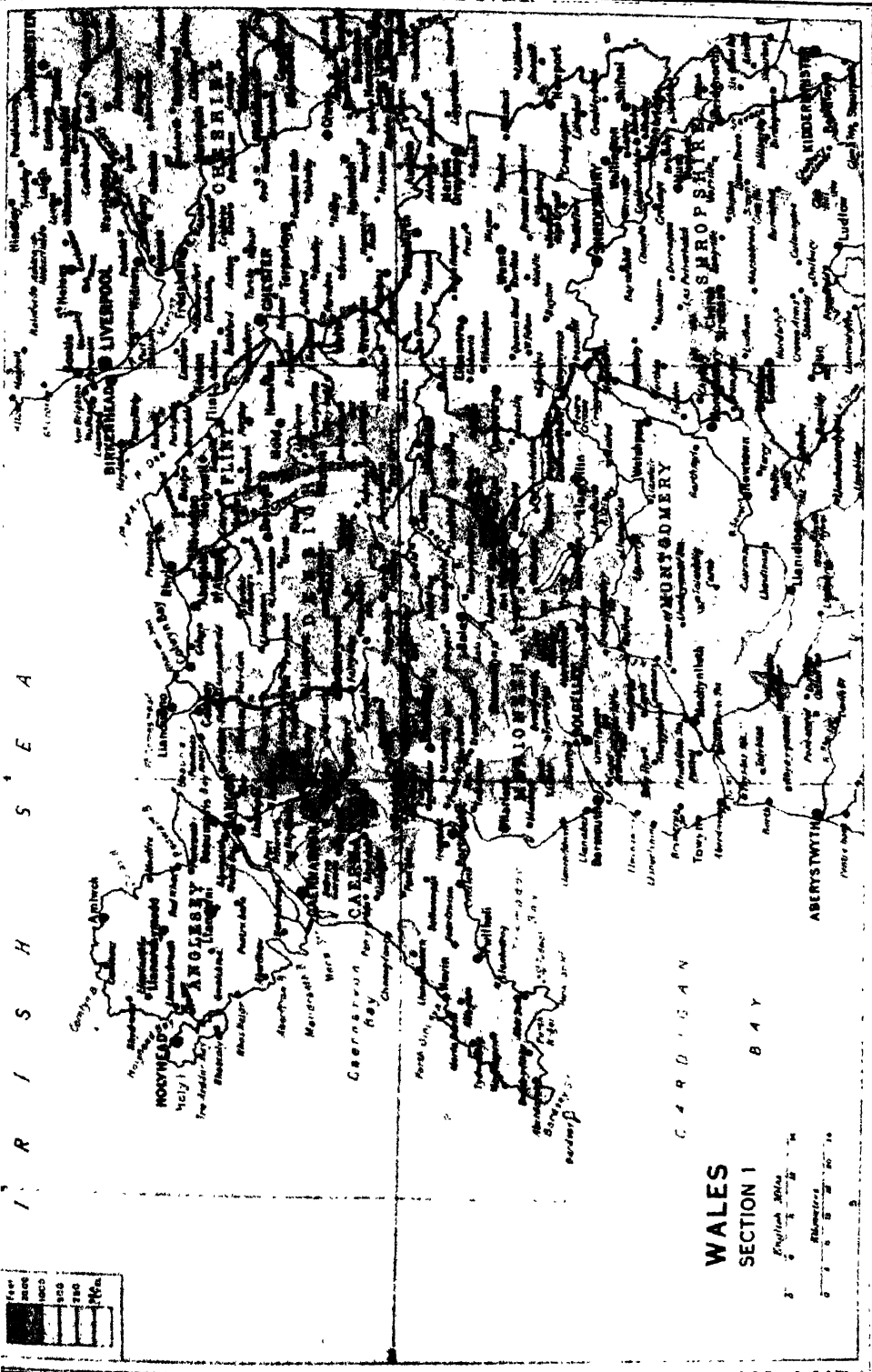
WALES SECTION I

English Miles
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I R I S H S E A



Rhondda is the centre of the mining industry. There are iron and steel industries at Merthyr Tydfil, Dowlais, Tredegar, Cardiff, and Newport, and copper, tinplate, and galvanized iron industries at Swansea and Port Talbot.

Other occupations of importance in Wales are slate quarrying at Llanberis, Festiniog, and elsewhere, and woollen mills at Lampeter. Around the coasts are many fishing ports, and many of them, on account of scenic charm, have grown to be famous seaside resorts such as Rhyl, Llandudno, Bangor, Aberystwyth, etc. Milford is now the chief fishing port. Pembroke was once a naval port, and Holyhead and Fishguard are ferry ports for the Irish Free State. There is no site central to the whole of Wales and thus Wales has no real capital. For different purposes, Cardiff, Caernarvon, and Aberystwyth share the function. The chief towns of Wales are described in more detail in separate articles.

Railways are much influenced by the distribution of surface relief. Routes between densely populated Southern Wales and England focus on Cardiff and Newport for the Severn Tunnel, and those between Northern Wales and England lead *via* Chester. Shrewsbury, in the Severn Valley, is a focus of routes from Central as well as Northern and Southern Wales. The route to Holyhead crosses the Menai Strait by the famous tubular Britannia bridge built in 1850 and only recently condemned.

People. The total population of Wales in 1931 was 2,158,374, and of Monmouthshire, 434,958. The Welsh show less Nordic strain than the other people of Great Britain, but on the coalfields in the south the population is very mixed. Of the total population of Wales, 97,418 or 3.9 per cent spoke only Welsh, and 786,880 or 32.5 per cent were bilingual. The Welsh language is least known in the south and east. Religion plays a great part in the lives of the Welsh, and chapels are very numerous and well attended. Most people belong to some Evangelical denomination, and the Wesleyan Methodists and Calvinists are par-

ticularly strong. In 1920 the Church in Wales and Monmouthshire was disestablished and partially disendowed, and Wales was formed into a separate Archbishopric. The Welsh are a musical people, especially fond of singing, and the national bardic festival (Eisteddfod) instituted in 1176 is still held annually.

Education. Wales has the same system of elementary and secondary education as England. Higher education is provided by the University of Wales with colleges at Bangor, Aberystwyth, Swansea, and Cardiff. The University was founded in 1893, and has a total of 3536 students. Although Wales is united with England in legislation

and administration it maintains several national institutions, including the National Library at Aberystwyth, the National Museum at Cardiff, and its own national health insurance scheme.

History. The aborigines (*circa* 3600 B.C.) of Wales are to be sought in a race having affinities with the Babylonians or Egyptians.

They were, therefore, non-Aryan, and their culture was related to that of the Semites. Probably their social system was based on the matrarchal principle. In the Bronze Age, the Goidels, a Celtic people, overran the country, and these were subsequently —after 400 B.C.—driven westward and northward to the forests and mountains by the next invaders, the Brythonic Celts. Probably the earliest later settlers became intermixed. In South Wales a pre-Celtic people, the Silures, held their own, and one of their chieftains, Caradoc or Caractacus, some time later stoutly resisted the Roman advance.

The invasion led by Julius Caesar had no important consequences for Wales, but that which was led by Aulus Plautius in A.D. 43 was more fateful, for the legions within a few years had pressed on to Chester and thence into North Wales. Caradoc was eventually defeated near Church Stratton, and thereafter the country was gradually reduced to subjection and held to obedience by the garrisons of numerous forts and blockhouses in South and Central Wales. It is still a matter of discussion as to how



CAERNARVON CASTLE
Photo. Frith



SNOWDON FROM LLYN LLYDAW
Photo. L. M. S.

far the country adopted the Roman civilization. Christianity was introduced A.D. 200, but in the anarchy which followed the withdrawal of the Roman legionaries, the country became pagan once again.

The effect of the Anglo-Saxon Conquest of Britain was to confine and to consolidate the Welsh nation within boundaries which have remained practically unchanged until to-day. A line of great kings offered a brave resistance: Vortigern, Maelwyn Gwynedd, Arthur, and Cadwaladr. In the struggle Brythons and Goidels united to make in effect a new people, the Cymri. Their defeat at the Battle of Winwaed (655) may be taken as the completion of the conquest, thenceforward the Cymric leaders were no longer called kings but princes.

The period of the princes dates from the death of Cadwaladr in 681. For some centuries there was weakness due to tribal wars, though at times under a strong man, such as Rhodri the Great (ninth century), unity was achieved. One of the greatest of the princes was Howel Dda, or the Good, who made a famous codification of Welsh laws and tribal customs. Gruffydd ap Llewelyn was supreme in the middle of the eleventh century and carried the fight

against the Saxons over the border, but was finally defeated and slain by Harold in 1063.

The struggle against Norman aggression went on for more than 200 years. As each Norman baron captured a slice of territory, his hold upon it was secured by the building of a castle. Upwards of a hundred castles were thus built to protect the conquests. Nevertheless Llewelyn the Great and his son David wellnigh succeeded in throwing off the Norman yoke during the early thirteenth century. Edward I invaded North Wales and imposed the Treaty of Conway in 1277, and five years later Llewelyn and David were captured and slain. The process of amalgamation with England then began, and the history of Wales as an independent State comes to an end. Owen Glendower made one further effort to assert the independence of the Welsh nation, but this too failed. The final assimilation of England and Wales was achieved by the Act of Union of 1536.

Language and Literature. Before the encroachments of the Northumbrians and Mercians pushed back the boundaries of Wales to their present position, the name Wales was given to all the western side of

Britain from Scotland down to Devon. Within this territory a Celtic language was spoken which is the ancestor of the native Welsh tongue.

The earliest records of Welsh literature are known as the *Four Ancient Books of Wales*, written after the close of the twelfth century.

Prose Tales and Poems. The Irish-speaking districts of north-western and south-western Wales were the home of the prose tales with traditional themes known as the *Mabinogion*, which show marked resemblances to the tales of Ireland. The work of the historian Nennius (ninth century) belongs to the old northern literature of Wales. The poets of the north were Aneirin and Taliessin, whose poetry is concerned with historical heroes who lived in Y Gogledd (the North) in the sixth century. Aneirin is credited with a poem called "Gododdin." It is known that the Gododdin were a tribe living in the district which is now the south-west of Scotland. The poem describes the warriors of this tribe drinking in the meadhall before going into battle against the Angles. Taliessin was probably the author of poems celebrating Urien and Owain, who were lords in Northern Wales.

The poetry of the north is more primitive than the *englyn* or epigrammatic verse written in the eastern and central parts of Wales in the sixth and seventh centuries. This eastern poetry is elegiac and meditative, with melancholy themes like the transitoriness of worldly glory and the sorrows of a lonely old age.

Welsh Poetry in the Medieval Period.

Few examples have been preserved of Welsh poetry written between the sixth and twelfth centuries, but the new poetry that appeared in Northern Wales in the first half of the twelfth century is evidently the climax of a long and unbroken tradition of poetical activity.

The poetry produced at this period was written by the *bards*, who were graded according to the nature of their duties and according to their standard of proficiency. The duty of the highest grade of bards was to extol God and their own temporal lords, they were not allowed to concern themselves with love or nature or satire, which were left to the lower-grade bards. The proficiency of the bards was decided at an *eisteddfod* or session of bards. (The modern National Eisteddfod in Wales is a late nineteenth-century innovation. (See EISTEDDFOD))

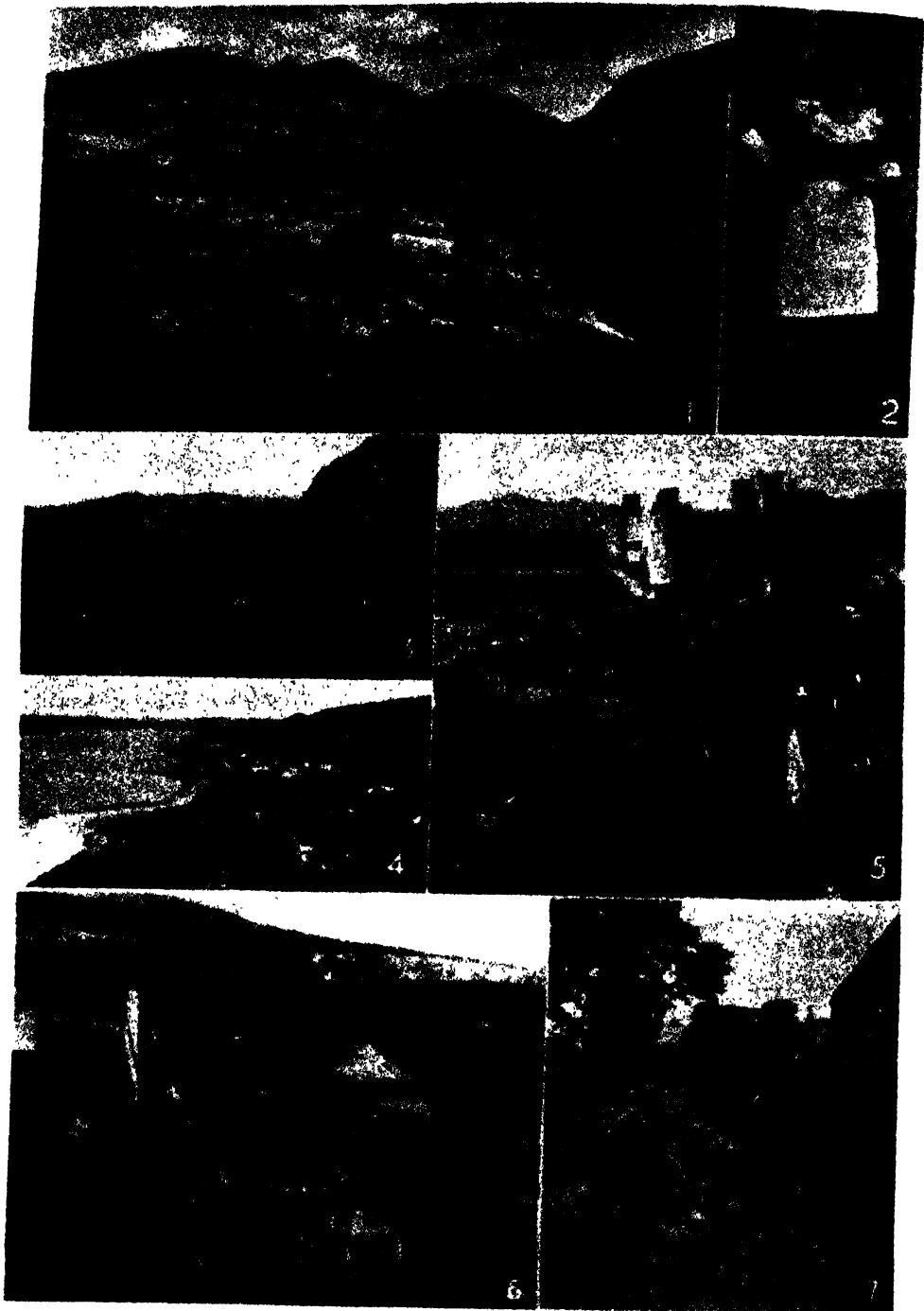
The bards made poetry a strictly conservative profession; in their hands poetry became elaborately archaic in grammar and diction, and understandable only to those who had had training in poetical form. At the beginning of the fourteenth century, however, this old tradition of poetry was considerably simplified by the poets Gruffydd ap Davydd, Casnodryn, and Gruffydd ap Maredudd.

A new and vigorous tradition in Welsh poetry was begun by Davydd ap Gwilym, called the "Welsh Chaucer" and father of modern Welsh poetry. His work was greatly influenced by the *trouvères* and *troubadours*; from them he adopted the conventional poetical forms. But the diction and content of his poetry were by no means



RHEIDOL VALLEY, CARDIGANSHIRE

Photo: L.M.S.



SCENES IN WALES

1. A valley near Beddgelert in the Snowdon range. 2. Station-mistress on a highland railway in native costume. 3. The Precipice Walk at Dolgelley. 4. Ferryda, Carmarthen. 5. Harlech Castle.
6. Coal mine at Ferndale in the Rhondda Valley. 7. An old cockle woman with her donkeys.

Photos: Frith, Topical

conventional. He was the first poet to select his vocabulary from the ordinary speech of educated Welshmen. His best work is his exquisite nature poetry.

Gwilym established the popularity of the *cywydd* or poem written in rhyming couplets of seven syllables, the rhyme consisting of one accented and one unaccented word. Among the contemporaries of Gwilym may be mentioned Iolo Goch (c. 1320-1400), whose *cywydd* to the Husbandman is famous.

Modern Welsh Prose. It is a curious fact that from about 1300 until well into the sixteenth century there is no Welsh prose of importance. Modern Welsh prose was brought into existence by various religious movements and by the Welsh Renaissance. The Reformation inspired several biblical translations and versions of religious books. Of the biblical translations the most famous is William Morgan's, published in 1588. Puritanism in Wales produced numerous original religious writings, the greatest of which is *Gweledigaethu y Bardd Cwsc* (1703).

In the next century the French Revolution caused much political prose to be written, e.g. the work of Samuel Roberts (1800-85). To this century also belongs Daniel Owen (1836-95), the Charles Dickens of Wales.

Modern Welsh Poetry. Apart from the vigorous survival of folk poetry, Welsh poetry was decadent during the fifteenth, sixteenth, and seventeenth centuries. It came into its own again in the middle of the eighteenth century in the work of Gronwy Owen. Owen and his followers were deeply influenced by the English Augustan poets, as well by their own native poetical traditions.

In this same century the Methodist Revival inspired a great deal of religious poetry in free metres, e.g. the hymns of William Pantycelyn (1717-91).

Of the present-day poets may be mentioned Thomas Gwynn Jones, R. William Parry and A. G. Prys Jones, and of the prose writers, Teg a Davies, the novelist.

WALES, PRINCE OF. See PRINCE OF WALES.

WALLACE, ALFRED RUSSEL (1823-1913). A

of natural selection. His early life was spent as a botanist and explorer. His investigations of the differences among primitive tribes made him a firm believer in evolution, and it was from this source that he originated and formulated his theory of natural selection. His theory is stated in his essay *On the Tendency of Varieties to Depart Indefinitely from the Original Type*, which was prepared about the same time as, and contained views strikingly similar to, Darwin's conception of the subject. Wallace also published works on natural history, spiritualism, and sociology.

WALLACE, EDGAR (1875-1932). An English novelist, journalist, and playwright. He was alternately soldier, journalist, and war correspondent. Subsequently, he became a prolific writer of fiction, especially of mystery stories, of which he wrote more than 150. His writings include *The Green Ribbon*, *The Indiarubber Man*, *Smithy*, *The Four Just Men*, *People of the River*, *The Green Archer*, *The Flying Squad*, and *White Face*. Among his plays are *The Ringer*, *The Terror*, *The Squeaker*, and *On the Spot*.

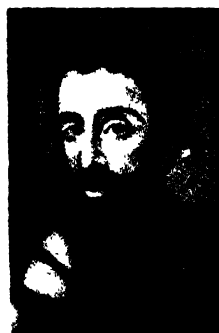
WALLACE, SIR WILLIAM (1272-1305). An heroic and romantic figure in the struggle for Scottish independence; was the son of a small landed proprietor near Paisley, and was educated at Dundee. Legends have gathered round his name, but he appears to have fallen foul of an Englisharrison (see EDWARD I of England), became a leader of outlaws and eventually the centre of national resistance. To Edward, convinced of his own legal suzerainty, he was merely a traitor, but Wallace had never accepted the English overlordship. His victory at Stirling Bridge in 1297 and his defeat at Falkirk in 1298 were followed by some years of obscurity.

In 1305 Wallace was betrayed into English hands. He was brought to London and there tried and convicted for treason at Westminster Hall. After his execution, with every circumstance of ignominy, his body was quartered and exhibited at several towns in the north of England and in Scotland as a warning of Edward's determination to reduce the Scots to subjection. The memory of Wallace is imperishable in Scotland. The brutality of Edward had



A. R. WALLACE
Photo: Brown Bros.

British naturalist and philosopher, who, independently of Darwin, originated a theory



WILLIAM WALLACE
Photo: Brown Bros.

the effect only of uniting the Scottish nation in a still fiercer hatred of the English yoke.

WAL(L)ACHIA, *wol lay' kia*. The southern plain of Rumania extending between the Transylvanian Alps and the Danube. With an area of 30,000 sq. miles it occupies a quarter of the whole state. The land is cold in winter and hot in summer, and rather dry at all seasons. The soil, however, is fertile and much wheat and maize are cultivated and there are many sheep. At Ploesti there are important oil wells. The population is entirely Rumanian. Bucharest, the capital of Rumania, lies in the Walachian plain. Braila is the chief Danube port. Walachia was an independent principality from 1330 until its union with Moldavia in 1891 to form the State of Rumania.

WALLASEY. Cheshire County Borough of 96,600 inhabitants, adjoining Birkenhead, on the south side of the Mersey estuary. It is served by the L.M.S.R., and is 206 miles from London. The county borough includes the seaside resort of New Brighton. Ferries run to Liverpool from Seacombe, Egremont, and New Brighton. The town is chiefly residential.

WALLENSTEIN, ALBERT EUSEBIUS WENZEL VON, Duke of Friedland, Sagan, and Mecklenburg (1583-1634). A German general and statesman, prominent in the Thirty Years' War. He was born at Herrmanic, Bohemia, of noble parentage. In 1617 he offered Ferdinand II, who had been proclaimed Holy Roman Emperor, 200 horsemen for service in the war against Venice, commanding them in person, and was created Count of the Empire and colonel in the imperial army. At the opening of the Thirty Years War, Wallenstein equipped a regiment of cuirassiers, and served throughout with marked ability.

Later he bought a large number of confiscated domains, and formed the territory of Friedland, of which in 1625 he was created duke. When the king of Denmark declared war on Ferdinand, Wallenstein offered 20,000 troops for his monarch's support, if placed in command. The offer was accepted, and Wallenstein joined Tilly in Northern Germany and defeated Mansfeld at Dessau. Peace having been established in Hungary, Wallenstein marched in 1627 to Silesia, and again joining forces with Tilly against the Danes, completely routed the enemy. In recognition of his services, the duchy of Mecklenburg was granted to him, and he was made admiral of the Baltic and generalissimo on land. His power gained him many enemies, and he was forced into retirement. On the death of Tilly, however, he was again placed in command of the Emperor

Ferdinand's army and once more drove the Saxons from Bohemia.

At the end of the war he retired to Bohemia whence he carried on intrigues with Sweden and other countries so that the Emperor was finally compelled to order his assassination.

WALLER, EDMUND (1606-1687). A cousin of Oliver Cromwell, he sat in Parliament from his youth, but owes his fame to his poetry. He wrote several beautiful lyrics and did much to make fashionable the heroic rhymed couplet. "Sacharissa," to whom much of his verse is written, was Lady Dorothy Sidney, daughter of the Earl of Leicester. He was banished for an obscure plot in 1643 but allowed to return in 1651.

WALLFLOWER. Sometimes called GILYFLOWER. A fragrant garden plant, native to Southern Europe, and so named from its



WALLFLOWER
Photo: Sutton & Sons

habit of growing on walls and along stony cliffs. At one time, it was called *heartsease*. The wallflower is a shrubby herb belonging to the mustard family, bearing clusters of single or double flowers. Colours are variegated.

Scientific Name. The wallflower belongs to the family *Cruciferae*. Its botanical name is *Cheiranthus cheiri*.

WALLINGFORD. See BERKSHIRE.

WALLIS ARCHIPELAGO OR UEA. A group of small coral islands 300 miles west of Samoa with a total land area of 37 sq. miles and a population of about 4500

Polynesians. Yams and bananas are grown. A French protectorate was declared in 1842. The islands are now a dependency of New Caledonia.

WALLOONS, *wol loonz'*. The Celtic inhabitants of the provinces of Southern Belgium, who are descendants of the ancient Belgae of Gaul who became Romanized. Until the fifteenth century, the Walloon dialect was the literary language of the country. There are about 3,000,000 Walloons in Belgium. See BELGIUM.

WALL PAINTING. See FRESCO.

WALLSEND. A Borough of Northumberland, 4 miles from Newcastle, with a population of 44,582. It is served by the L. N.E.R. and is 272 miles from London. Its name comes from the fact that the town is at the end of Hadrian's Wall. The famous Wallsend coal was first mined in 1586. Shipbuilding and marine engineering were introduced, the former in 1759, the latter about 1850, and became leading industries of the town. During the settled days of the Roman occupation in the north, A.D. 80-383, Wallsend was not only an important fort, but a considerable civil centre where sea-borne goods were unloaded and dispatched elsewhere. At the Norman Conquest the area was in the hands of the monastery of Lindisfarne.

WALNUT. Any one of a genus of nut-bearing trees, consisting of about a dozen species, which are valued for their wood,



LEAVES AND FRUIT OF THE BLACK WALNUT

which is used in cabinet making, and their sweet, edible nuts. The trees have compound leaves, with many leaflets arranged alternately on the stems. There are several species, the best known of which is the Persian or common walnut. This species was brought from Persia to Southern Europe, and from there it was taken to England. The tree grows from 60 ft. to 90 ft. in height, and bears large, spreading branches. Its

nuts are sweet and nutritious when ripe, and when unripe they make good pickles and ketchup. Its wood is lighter than that



WALNUTS RUINED BY CODLING MOTHS

On the right can be seen where the maggot has entered the nut. On the left a nut has been split open to show the larva and the damage it has caused.

Photo P. & A.

of the American black walnut, but is hard and fine-grained.

Scientific Names. The walnuts belong to the family *Juglandaceae* and to the genus *Juglans*. The common walnut is *J. regia*. The black walnut is *J. nigra*.

WALPOLE. The family name of two eminent Englishmen of the eighteenth century, father and son. See ORFORD, EARLS OF.

WALPOLE, HUGH SEYMOUR (born 1884). An English novelist, son of the Right Reverend G. H. S. Walpole, bishop of Edinburgh. A schoolmaster in early life, after the publication of *The Wooden Horse*, in 1909, he turned to literature as a profession.

Walpole's style reveals an easy flow of language and a keen sense for the arrangement of words. It shows a richness of imagination, yet gives an impression of great reserves of power. His published works include *Jeremy*, *Jeremy and Hamlet*, *Jeremy at Crale*, *The Cathedral*, *Harmer John*, *Golden Scarecrow*, *Portrait of a Man with Red Hair*, *Wintersmoon*, *Fortitude*, *Rogue Herries*, *Judith Paris*, and *The Fortress*.

WALRUS. A carnivorous animal which lives almost entirely in water. It is rather like a seal but is easily identified by its tusks, which are greatly elongated, upper canine teeth, and its thick growth of whiskers. There are no external ears, and the eyes are small; an adult specimen may measure about 10 ft. Like other sea mammals, walrus at one time lived on land. Now their structure is modified for life in the sea. The hind limbs are webbed and twisted far back in imitation of the tail fan of a whale; but they are not so completely modified as in the



AFTER A WALRUS HUNT

This loaded Eskimo sledge was photographed in Alaska.

Photo: Visual Education Service

seal, and they are still capable of being partly used as limbs for hobbling on land.

Walrus live along the edge of Arctic ice floes.

Scientific Names. The two known species of walrus constitute the family *Odobenidae*. The Atlantic species is *Odobenus rosmarus*; the Pacific, *O. obesus*.

WALSALL. A few miles from Birmingham and Wolverhampton, 120 miles from

London, on the L.M.S.R., is the second largest town of South Staffordshire, Walsall, with a population of 103,102. The two chief industries are those of leather and iron, the former having been important for many generations. The town has been long noted for saddlery and harness making. Pig iron and puddle iron, and finished iron of nearly every description, are produced in the borough. Engineering is also important, while many products for the motor-car trade are made in great and increasing quantities. Other industries are clothing, building materials, electrical machinery, etc. The history of the town dates back to very ancient times. It became a parliamentary borough in 1832.

WALSINGHAM, SIR FRANCIS (1530-1590) English statesman. He was educated at King's College, Cambridge, and studied law at Gray's Inn. He became chief of the secret service in 1569, and from 1573 to 1590 was secretary of state. His diplomatic negotiations included an attempt to obtain indulgence for the Huguenots of Paris, and the discussion of various marriage projects between Queen Elizabeth and continental princes. He was successful in thwarting a number of plots threatening the queen, including the Babington Plot, and later urged the execution of Mary Queen of Scots. A strong Protestant with a leaning to Puritanism, he was the ablest of Leicester's party, who urged encouragement of the privateers and defiance of Spain.

WALTHAMSTOW. A north-eastern suburb of London, a Borough of Essex, with a population of 132,965. It is served by the L.M.S.R. and L.N.E.R. Walthamstow was



WALRUS

Photo: Wide World

a Saxon settlement, while Roman remains have been found in the district. As *Walcumestou*, it is mentioned in the Domesday Book. Walthamstow was created a municipal borough in 1929. The Parish Church St. Mary dates from 1108. An important and interesting building is Salisbury Hall (once owned by the Countess of Salisbury who was executed by Henry VIII). Essex Hall (Elizabethan) was lately demolished.



ISAAC WALTON

Photo: Brown Bros

WALTON, IZAAK (1593-1683). An English author. In 1653 Walton published his famous *Compleat Angler, or the Contemplative Man's Recreation*. This work was intended actually to instruct its readers in the art of fishing, but is technically of little value, it is read and admired because, from first to last, it is full of a gentle humour and a delight in the

charms of out-of-door life. Walton's other works include several poems and a few leisurely, informal biographies.

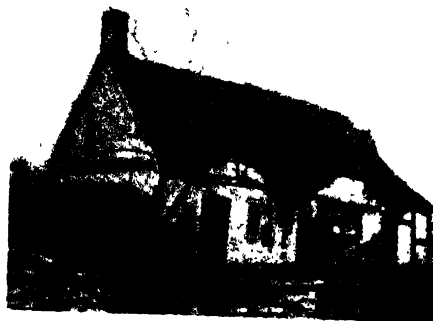
WALTZ. See DANCING

WANTAGE. See BERKSHIRE

WAPITI, *wah' pit i*. A species of deer found in the North-western United States and Canada, also called *elk*, but mistakenly so. It varies from the true elk in colouring, in length of tail, and has a fourth tine to the antler.

WARBECK, PERKIN (about 1474-1499). A pretender to the English crown in opposition to Henry VII. He was born in Tournay, Flanders, the son of poor parents. He claimed to be Richard, Duke of York, the younger of the two royal princes, sons of Edward IV, whom Richard III imprisoned in the Tower and murdered. He found supporters and Mary of York, dowager Duchess of Burgundy and sister of Edward IV of England, welcomed him as the real heir to the throne. In 1495 James IV of Scotland even gave Warbeck his cousin, Catherine Gordon, in marriage. Several European sovereigns, enemies of Henry VII, also gave him their support. He found supporters in Ireland, always friendly to the House of York. In 1497 Warbeck made an unsuccessful expedition into England, and was captured, but treated leniently. However, he continued to plot, and in 1499 Henry VII caused him to be executed after he had made

two public confessions of his parentage and early years as a house servant. His resemblance to the Plantagenets has caused many to think that his claim may have been true, but there seems no reason to doubt that the discovered bodies of Edward IV's sons have been truly identified. It has been suggested that he may have been an illegi-



IZAAC WALTON'S COTTAGE

It is near Shallowford, Stafford.

Photo: Wide World

itimate son of Edward IV, there is no evidence for this, but the theory is worth consideration.

WARBLER. A common name for many species of birds belonging to the same family as the flycatchers and thrushes. The warblers are not a separate and clearly defined group but belong to many different genera, the original probably being the



WILLOW WARBLER AT NEST

Photo: John Kearton

genus *Sylvia*, which also includes the blackcap and whitethroat. As a whole, warblers are generally small, drably coloured birds with very active but skulking habits. All are good singers. The garden warbler and blackcap sometimes sing at night and are mistaken for the nightingale. All the commoner species found in Britain are summer

visitors, roughly during the months April to September. Their food consists mainly of insects, and occasionally fruits in their season.

Probably the commonest species is the garden-warbler. It is typical of garden and shrubbery in England and Southern Scotland. Its colour is characteristically drab, being a uniform olive-brown, except for a paler shade on the underside.

The willow-warbler, which is closely allied to the chiffchaff, is also a common summer resident, and is found in rather more open country. The nest, made of grass and moss lined with feathers, is only open at the side. It differs from the garden-warbler in having a yellowish plumage. It has a near neighbour in the wood-warbler which, as its name implies, has a rather different habitat. The wood-warbler is larger and greener above with a characteristic yellow throat.

The grasshopper-warbler frequents open country, common, and marshland. It is recognized by its brownish-green colour.

There are three fairly common warblers inhabiting more marshy districts. These are the reed-, marsh-, and sedge-warblers. The first warbler is fairly large, brownish above and nearly white below. The marsh-warbler is less common but very similar in appearance, habits, and distribution. The sedge-warbler is more common and not so confined to marshy districts. It can be distinguished by its streaked head.

WARBURTON, WILLIAM. See ENGLISH LITERATURE.

WARD, MRS. HUMPHRY (MARY AUGUSTA ARNOLD) (1851-1920). An English novelist,



MRS. HUMPHRY WARD
Photo. Brown Bros.

the niece of the famous Matthew Arnold. Of Australian birth, she was educated in England, and in 1872 married Thomas Humphry Ward, a tutor of Brasenose College, Oxford, and himself an author of note. Mrs. Ward's first literary efforts were contributions to periodicals; it was not until 1888 that her first successful novel, *Robert Elsmere*, appeared. Thereafter, her fer-

tile mind and active pen presented numerous other works.

WAR DEBTS. A Reparations Committee was established under the Treaty of Versailles to consider the whole question of

Germany's debt to the Allies. The principal items of the account were the reconstruction of the devastated areas, especially in the north-east of France; the capital value of pensions and allowances; and the cost of armaments and ships.

The Reparations Committee, after numerous meetings, reported in April, 1921, its findings. The total bill came to 132,000,000,000 gold marks, equivalent to £6,600,000,000 sterling.

Arrangements were made for the issue of certain bonds on which interest was to be paid by Germany in gold marks together with 26 per cent of the value of her exports. The attempt to purchase foreign currency brought down the value of the mark. Normally worth about a shilling, it fell disastrously until it had little more than paper value. The German Government was unable in such circumstances to finance its budget, much less to finance the bonds. A moratorium was applied for and ultimately granted, but France, under the leadership of Poincaré, insisted on the military occupation of the Ruhr district as a form of pledge.

The invasion of the Ruhr, the chief industrial region of Germany, further reduced her ability, and indeed her willingness, to meet reparation claims. In 1924 the Dawes Committee drew up a scheme which found acceptance. This involved a drastic scaling down of the annual payments and a withdrawal from the Ruhr. The question of Germany's total indebtedness was left over for later consideration.

In June, 1929, the Young Committee further reduced the payments and settled the total amount, but within six months, a disastrous break in the New York stock market heralded the bankruptcy of World trade. By 1931 the depression was at its worst and Germany could pay nothing. Mr. Hoover proposed a moratorium in the same year.

Apart from the reparation payments due to the Allies from Germany, many of the Allies were in debt to others for financial loans made during the war.

Britain and the United States were the largest creditors. In 1922 the amount of the British War Debt to the United States was £920,000,000. Britain stated that she would only ask from her debtors sufficient to pay her own debts. Owing to financial difficulties many of the nations have had to default on their agreements. Britain is at present making a "token" payment annually to the U.S.A., which is just sufficient to cover interest charges.

WARDEN OF THE MARCHES. In the fourteenth, fifteenth and sixteenth centuries, there might be peace between England and

Scotland, but there was little peace on the Border. Both sovereigns therefore appointed great lords to keep the peace, with the title of Warden of the Marches, that is, Guardians of the Borders, who had extensive powers and jurisdiction.

WARD OF COURT. A person under the age of 21 who is under the guardianship of the High Court of Justice. The Court decides how the ward is to be educated; its consent is required to the ward's marriage; and the ward must not be taken out of the country without the Court's permission.

WAR, EUROPEAN. See **WORLD WAR**.

WAR OF 1812. When this war broke out Britain was waging a life-and-death struggle with France, which, to a great extent, was still supreme on land in Europe. Britain successfully blockaded all ports of countries friendly to Napoleon, and though Napoleon attempted retaliatory methods these were unsuccessful. America suffered severely from the action of Britain, although Britain could not with safety allow Napoleon to be given supplies, and feeling ran high in both countries. In 1812 President Madison in advocating war gave the following reasons: (1) The impressment of American seamen into the British Navy. (2) Virtual blockade of U.S. waters. (3) Orders in Council which drove American ships from the seas. (4) The belief that British agents had instigated Indian risings.

During 1812, American frigates and privateers of all kinds attacked British shipping and inflicted considerable damage. Again in 1813, besides several small naval successes the Americans won the important Battle of Moraviantown, though earlier a detachment was defeated at Raisin River. In the same year the British won engagements at Chateauguay and Chrysler's Farm. In 1814, Britain having won the Napoleonic War was able to give more attention to the American War. In July the two armies met at Lundy's Lane, and the Americans were forced to withdraw. In August the British force took and sacked Washington, but in September a British attack on Plattsburg was repulsed, as was also one on Baltimore. Although peace was signed on 24th December, the news did not arrive in time to prevent a strong attack by the British on New Orleans. This attack was repulsed with great loss to the British. [In the *Dominions and India Volume* (Canadian Section) will be found articles on Chateauguay, Chrysler's Farm, Lundy's Lane, and Moraviantown.]

WAR OFFICE. The department controlling the military forces of the British Government. The Cabinet minister responsible to Parliament for the work of the War

Office is the Secretary of State for War, whose office was created in 1854 at the time of the Crimean War. Hitherto there had been one Secretary of State for War and the Colonies whose duties were then apportioned to two Secretaries.

The work of the War Office is controlled by the Army Council, dating from 1904, whose secretary is the Permanent Under-Secretary for War. In addition to the Secretary of State for War, assisted by his Parliamentary Under-Secretary and a third politician—the Financial Secretary to the War Office—there are four Military Members of the Army Council known as the Chief of the Imperial General Staff, the Adjutant-General to the Forces, the Quartermaster-General to the Forces, and the Master-General of Ordnance. In 1936 a Director-General of Munitions Production was appointed as an additional member.

WAR OF SECESSION. A conflict between a divided people in the American republic. Beginning in 1861 the struggle continued until 1865. Economic differences caused the quarrel. The industrial North desired high protective tariffs, detested by the agricultural South, a consumer of manufactured goods. The North desired a National Bank; the South held that this would violate State rights and give too much power to Northern financiers. Another issue was whether the new Western territories should be slave or free.

Slavery had existed in America since 1619. Economic conditions in the North did not favour the retention of slaves, but in the cotton-growing South, slave labour was an important factor in the industry.

In 1860 eleven States in the South seceded after the election of President Lincoln, who had put forward an anti-slavery programme. See **LINCOLN, ABRAHAM**.

The economic and social problems had revived the old constitutional clash of Jefferson and Hamilton—State rights versus Union sovereignty. The war was fought not over slavery but over the right to secede. The Confederate States of the South elected Jefferson Davis as President. Their troops wore grey uniforms, the Federalists blue.

The seceding States at once took possession of government property within their borders, and sent a commission to the United States government to arrange suitable terms of payment. President Lincoln would not treat with the commissioners, and determined to make the seceding States submit to force of arms.

The conflict appeared unequal at the start. The resources of the North were infinitely greater than those of the South.

The first serious engagement was on 21st July, in which the Confederates defeated the Union forces at Bull Run and threatened the city of Washington.

In 1862, Captain, later Admiral, Farragut, attacked with his fleet the strong defences of New Orleans from the south. The assault lasted a week, and the city fell. The fall of Vicksburg and Port Hudson did not occur until July, 1863; from that date, the Union controlled the Mississippi.

The battles of Yorktown, Williamsburg, Seven Pines, Fair Oaks, and other lesser engagements resulted in no glory to the Federals, for the Confederates under Lee captured many prisoners and forced McClellan back toward Washington. Lee pressed his advantage, advancing toward the Potomac, threatening Washington and winning the second Battle of Bull Run. At Antietam (17th September) one of the greatest battles of the war was fought, and Lee was driven back into Virginia, but he won the battle of Fredericksburg.

In May, 1863, the Federals, now commanded by Hooker, again started to hammer their way toward Richmond. At Chancellorsville (2nd to 4th May) they were decisively defeated, but the victory cost the Confederates dearly, as "Stonewall" Jackson was there killed. Emboldened by his success, Lee again invaded the North, but at Gettysburg he was driven back.

In July, the Unionists captured Chattanooga, but in pursuing their advantage were defeated at Chickamauga. In three memorable battles in November, the Confederates were driven back into Georgia. Sherman, under Grant, made it impossible for the Confederates to return to the attacks around Chattanooga, by raiding across the Mississippi and destroying their lines of communication at Meridian. The successes of the year raised Grant to the post of general-in-chief early in 1864.

The decisive victories at Gettysburg and Vicksburg in 1863 had encouraged the Union commanders. Lee guarded Richmond; Johnston held the central South safe from the Federals, by virtue of a strong force in Northern Georgia. Grant determined to address himself to Lee and the capture of Richmond. To Sherman was assigned the task of defeating Johnston and then marching across the South to the sea. He entered Atlanta 2nd September, and began the famous march "from Atlanta to the sea."

On 22nd December he captured Savannah, and turned northward on 1st February, 1865, to unite with Grant.

In the East, in May and June, Grant fought the forces of Lee, Longstreet, and other leaders of the Confederacy. He lost

over 60,000 men, but forced Lee to retreat into Richmond.

Lee was shut up in Richmond with about 40,000 men; the besiegers had over 100,000 troops. Grant captured Petersburg on 2nd April, 1865; Lee evacuated Richmond the next day, and the Federals entered the capital. President Davis escaped to North Carolina. On 9th April, Lee surrendered what remained of the Confederate army at Appomattox Court House, 75 miles west of Richmond.

WARP. See WEAVING; CLOTH.

WARRANT. In law, a document signed and sealed by a magistrate, authorizing a police officer to do something which would otherwise be unlawful. The most important kinds of warrants are (a) *warrants of arrest*; (b) *search warrants*, authorizing police officers to enter and search private premises; (c) *distress warrants*, authorizing the seizure of goods belonging to a person who has been ordered to pay a fine or the costs of a prosecution and who has failed to pay.

WARRANT OFFICER. See ARMY.

WARRANTY. An undertaking given by one party to a contract to the other party, and having reference to the subject-matter of the contract, but *collateral* to (i.e. apart from) the main purpose of the contract. A warranty is distinguished on the one hand from a *condition*, which is an undertaking not collateral, but essential to the main purpose of the contract; and, on the other hand, from a mere *representation*, which is a statement made by one of the contracting parties about the subject-matter of the contract, but without any express or implied promise that the statement is true. An important type of warranty is an agent's *implied warranty of authority*; this means that when A enters into a contract with B purporting to act as C's agent, A impliedly undertakes that he has C's authority to make the contract on his behalf; and if it afterwards turns out that A had no such authority, and C repudiates the contract, A will be liable to pay damages to B.

See AGENT; CONTRACT.

WARRINGTON. Situated on the River Mersey in Lancashire, with a population of 81,710; area 4532 acres. It is a County Borough and market town served by L.M.S. and Cheshire lines of railway. The boundary on the south side is defined by the Manchester Ship Canal. The town is 182 miles from London. Its history dates back to the times when it was a Roman camp known as Veratinum. Is mentioned in Domesday as Walintune. Known as the "town of many industries," its manufactures include cotton, hardware, soap, tanning, chemicals, beer, agricultural seeds, aluminium, etc.

WARSAW, officially **WARSZAWA**, *var shah'va* (Polish). The capital of Poland and the chief city of the province of Warsaw, situated on the south (left) bank of the River Vistula. Founded probably about the beginning of the thirteenth century, it is now a leading industrial and commercial centre, having numerous book-printing houses, and flourishing factories producing machinery, food products, woven goods, boots and shoes, and many other commodities. There is a thriving trade in grain, coal, and leather. The population numbers 1,225,000 (1934), of whom nearly 35 per cent are Jews.

WART. A growth caused by the thickening and hardening of layers of skin over a small area, and the result of some form of irritation; there may be one or several, but the tendency is for several to form. Occasionally, small blood-vessels grow into a wart, but it is frequently dry and hard. The standard form of treatment consists in cutting off the wart close to the skin, and then burning the base with an acid. Strong nitric acid, applied persistently to the wart, will destroy it. By whatever means warts are removed they have a tendency to recur, and also to spread from one part of the skin to another.

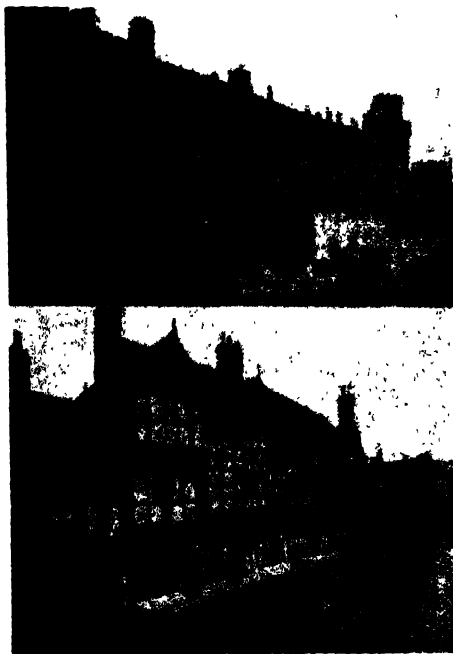
WART-HOG. An African pig very ugly in appearance. It has enormous tusks curved up over the snout and a large wart on each side of the face below the eyes. The skin is almost without hair. Wart-hogs generally live in swampy places, are shy in their habits, and feed at night.

Scientific Name. Wart hogs belong to the family *Suidae*.

WARTON, THOMAS (1728-1790). Warton is now remembered less for his own poetry than for his famous *History of English Poetry* (1774). But he achieved a considerable academic reputation in his own day by the publication of *The Triumph of Isis* (1749), a heroic poem in praise of Oxford,



WART-HOG
Photo: Photopress



(Above) The Castle.
(Below) Leicester Hospital.
Photos Frith

and by his anthology of Oxford wit entitled *The Oxford Sausage* (1764). His *History* did much to awaken an interest in medieval and Elizabethan poetry among Warton's contemporaries.

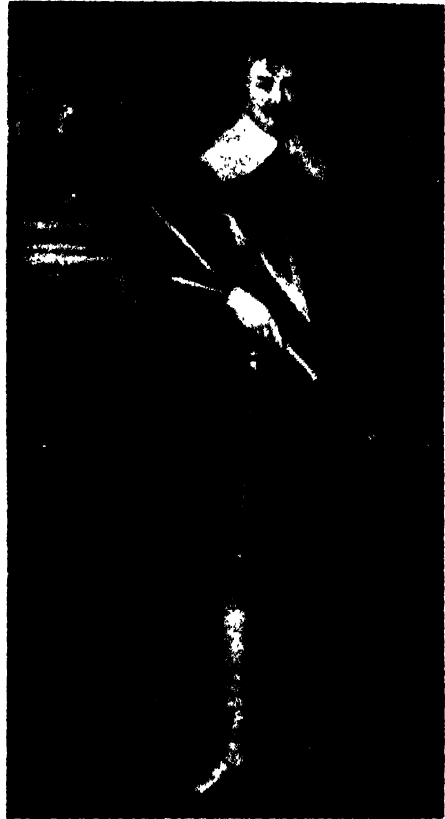
WARWICK. A Municipal Borough, the county town and market town of Warwickshire with an area of 5057 acres and a population in 1931 of 13,459. Saxon township and medieval walled town, Warwick is to-day the centre of a vigorous agricultural country, and though the art of woodwork, which for many centuries was carried on by the craftsmen of the town, has died out, several modern industries, particularly those connected with the manufacture of foodstuffs for the local market, have taken its place. Its chief antiquarian interest lies in the castle, on the site of which, tradition relates, a fortress was built in 915 by Ethelflaeda, daughter of Alfred the Great—a site which is marked to-day by Ethelflaeda's mound. This was succeeded by a Norman keep, part of the fabric of which is preserved. The greater part, however, of the present buildings dates from the fourteenth and fifteenth centuries. Second only in interest to the Castle is St. Mary's Church which is a perfect example of the archi-

ture of the later seventeenth century and includes the fifteenth-century Beauchamp Chapel with its great wealth of sculpture and stained glass. An ancient ducking stool has been preserved in the crypt. The ruins of the priory, which was one of the wealthiest foundations in the Midlands, have been taken down and re-erected in America. The Leicester Hospital is a fine sixteenth-century building; founded by Robert Dudley as an almshouse, contains some beautiful half-timbered work. The gatehouse is thought to have formed part of the medieval defences of the town. There are also a number of half-timbered houses, including one celebrated as the birthplace of the poet Landor, which has now been incorporated into the King's High School. The gabled mansion, St John's House, erected in 1653, and the Shire Hall in North Gate Street are other buildings of unusual interest.

WARWICK, DUKES AND EARLS OF. Henry de Newburgh was created Earl of Warwick, probably by William I, and received from William II the estates of Torquil of Warwick. Before the Conquest there had been no earldom, although the legendary hero, Guy of Warwick, slayer of the great Dun Cow, was later said to have been an Earl. The Newburgh family increased in wealth and power. Henry, 5th Earl, was a strong supporter of John and Henry III. Margery, his daughter and eventual heiress, married John de Plessetis, a renowned soldier and a close friend of the king. After his death and that of Margery, the earldom passed to her cousin, William Mauduit, who was taken prisoner by the baronial faction. He died in 1267, the next earl being William de Beauchamp of Elmley, the son of his sister, Isabel. His son Guy (died 1315) was, like William, one of the captains of Edward I, but his hatred of Gaveston made him disloyal to Edward of Caernarvon (see EDWARD II). Thomas (died 1369) and John, his sons, were original Garter knights; at Crécy, John was standard-bearer and Thomas led the van, under the nominal command of the young Prince of Wales. Thomas (died 1401), son of Earl Thomas, was one of the Lords Appellant; he was imprisoned in 1398 by Richard II, but reinstated by Henry IV in the next year. His son Richard (1381-1439) became one of the great captains of the time. He fought against Glendower and Harry Hotspur, went on pilgrimage to the Holy Land, and served Henry V both as diplomat and as soldier. He was guardian to young Henry VI; commanded at Rouen when Joan of Arc was burned, and won the fight of Savignies. His son Henry (1423-45) was in 1444 declared

the Premier Earl and later made Duke of Warwick. On his death and that of his daughter Anne, the title passed in 1449 to his sister Anne's husband, Richard Neville.

RICHARD (1428-71) was the son of Richard, Earl of Salisbury, a brother-in-law of the Duke of York, whose cause father and son supported against Margaret of Anjou. Warwick won the first St. Albans battle in 1455.



EARL OF WARWICK
From a painting by Van Dyck.
Photo: Brown Bros.

He became Captain of Calais; his attacks on Spanish and German fleets followed the old custom of the narrow seas rather than the laws of war and would now be regarded as piratical. In 1460 he captured Henry VI at Northampton. He was defeated by the queen at St. Albans in the next year, but he was chiefly responsible for Edward IV's assumption of the throne and his victory at Towton. After some years of power, jealousy of the new queen's relations, and chagrin at Edward's disregard of his advice,

made him look for a new king. He turned Lancastrian and was defeated and killed at Barnet (see EDWARD IV). "The Kingmaker's" elder daughter Isabel married George, Duke of Clarence, and their son, Edward, Earl of Warwick, after many years in the Tower was beheaded in 1499, ostensibly for attempting to escape with Perkin Warbeck, but actually for being a nephew of Edward IV. Royal blood was equally fatal to his sister, Margaret, Countess of Salisbury, beheaded in 1541 at over seventy; she was the mother of Cardinal Pole (see POLE, REGINALD). Anne, the Kingmaker's younger daughter, was married first to Edward, son of Henry VI, and then to Richard of Gloucester. See RICHARD III OF ENGLAND.

John Dudley, Viscount l'Isle, was created Earl of Warwick in 1547 (see NORTHUMBERLAND, DUKES AND EARLS OF). His eldest son, John, who bore the title by courtesy, was condemned with his father in 1553, but spared; he died in the next year. Ambrose (died 1590), the second son, was in 1561 created Earl of Warwick by Elizabeth, at whose court he was an important figure. He was Lieutenant-General of her forces in the insurrection of the northern earls in 1569. Robert, Lord Rich, was made Earl of Warwick in 1618. His eldest son, Robert, was a Puritan and a friend of Pym; he was Admiral for the Parliament. This line became extinct in 1759, when the earldom was conferred on Francis Greville, Earl Brooke, a descendant from the great house of de Beauchamp; from him descends the present holder of the title.

WARWICKSHIRE.

The county of Warwick situated in the centre of England is bounded by the seven counties of Stafford, Derby, Leicester, Worcester, Gloucester, Oxford, and Northampton. The administrative county has an area of 558,740 acres and a population of 374,170.

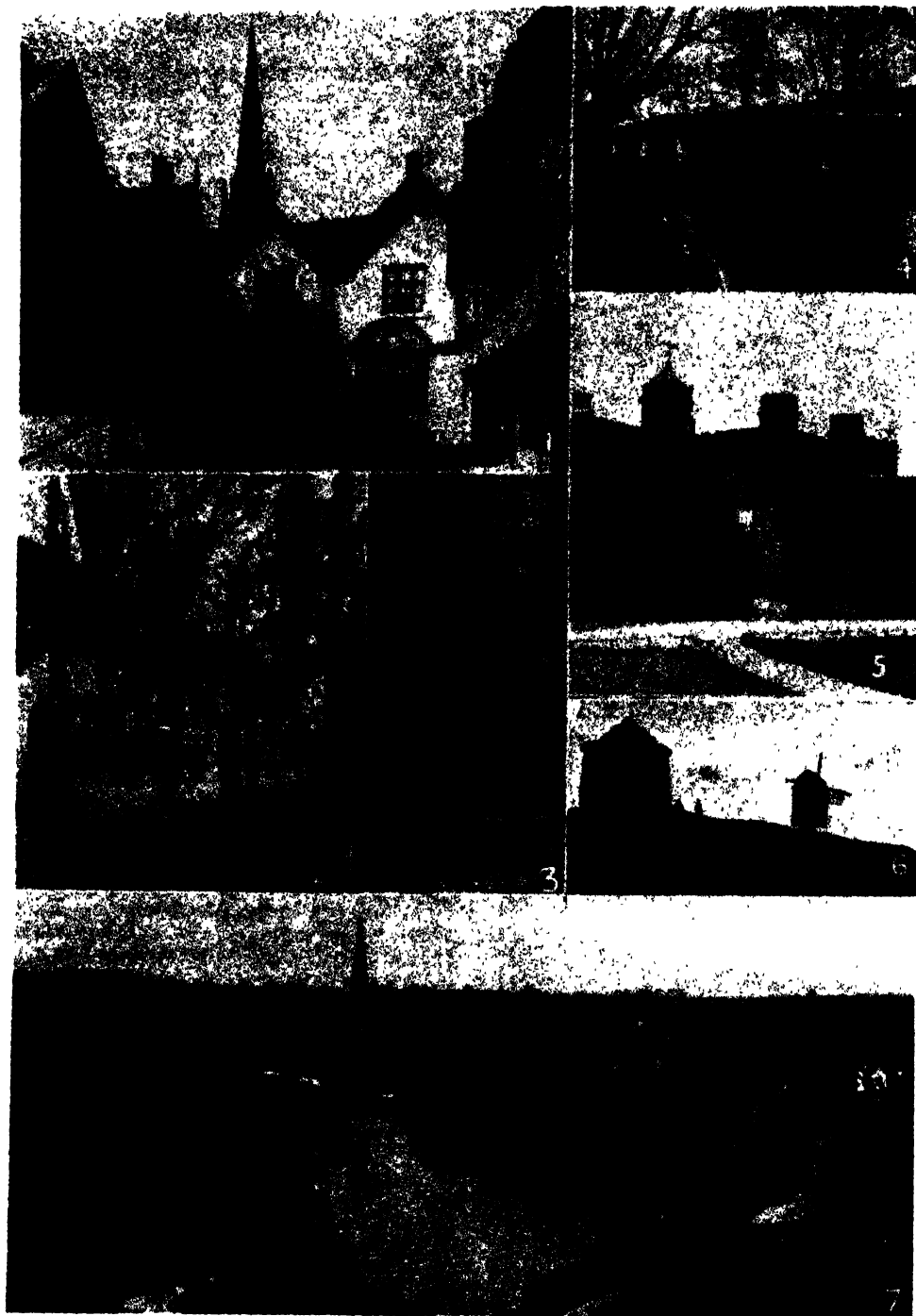
Physical Features. Most of the county is flat, and in the west is well-wooded (Forest of Arden). There are low hills on the west and south-west, and spurs of the Cotswolds lie in the south, Edge Hill (over 800 ft.) being the chief height. The River Avon—the "Upper Avon"—enters the county from Northamptonshire and flows south-west through Rugby, Warwick, and Stratford. Its chief tributaries are the Leam and the Tame. The average rainfall of the eastern half of the county is under 30 in.; that of

the western half between 30 in. and 40 in. The county contains rich seams of coal, many of them of comparatively recent working.

History. In Roman times the area was densely wooded and largely an uninhabited one, bounded by the three great Roman roads Icknield Street, the Fosse Way, and Watling Street. (These roads are still in use.) After the Peace of Wedmore (A.D. 878)



the invading Danes were confined to the country to the east of Watling Street, and so it was possible for Ethelflaeda, the Lady of the Mercians and daughter of Alfred the Great, to establish the first "burh" (fortified encampment) at Warwick. This, however, was frequently attacked by the Danes, and Warwickshire suffered for its nearness to the boundary of the Danelaw by frequent depredations. At the Conquest the county was considered loyal, but after a rebellion, William built the first stone castle at Warwick and put one of his Norman followers in charge. It was not until much later times that the county became an organized entity. Under Stephen the county supported Queen Matilda. Simon de Montfort held Kenilworth and the surrounding country against Henry III and endured a long siege. Edward II was



WARWICKSHIRE

1. Palace Yard at Coventry; the spire behind is that of Holy Trinity Church. 2. Guys Cliff Mill, Warwick. 3. Combined pillory, whipping post and stocks at Colleshill, Warwick. It has been extensively renovated. 4. Pack horse bridge at Harpenden-in-Arden. 5. The old building at Rugby School. 6. Burton Dassett mill. 7. Stratford-on-Avon.

Photos: Frith; Taylor; George Long

deposed at Kenilworth. Many Warwickshire men joined in Wat Tyler's rebellion, and the county generally was under the influence of the Duke of Lancaster who subsequently became Henry IV. In the reign of Henry VI Warwick "the Kingmaker" swayed the county first against that King and then against Edward, Duke of York, afterwards Edward IV. At the end of the Wars of the Roses, Warwickshire was loyal to the Crown for a lengthy period. The famous Gunpowder Plot was conceived and planned in Warwickshire, but on its failure the conspirators fled into Staffordshire. Most of the county favoured the Parliamentary side in the Civil War, and there were many fights within the borders, chief being the battle of Edge Hill in 1642. Few untoward happenings disturbed succeeding years, and the great city of Birmingham began its steady growth.

Warwick Castle stands in beautiful country overlooking the River Avon, and is one of the few midland Norman castles that are not in ruins. Oliver Cromwell destroyed most of them. Five miles from Warwick are the ruins of Kenilworth Castle.

Warwickshire contains the "Shakespeare country." The poet was born and lived most of his younger days at Stratford-on-Avon. It was there, also, that he died. Thousands of people visit his birthplace every summer.

Transport. The main lines of the L.M.S.R. and G.W.R. run through the county, and there is a network of branch lines. Roads are good, and canals provide water connection with the rivers Thames, Trent, Mersey, and Severn.

Agriculture and Industries. There are many rich agricultural districts, and agriculture has become of great importance. The farmers are up-to-date and progressive in their methods and in their use of machinery. Sugar beet is increasingly grown, and market gardening has Kenilworth as its centre. The industries are described in the articles on the various towns. They include coal-mining, the making of hardware, cement, machine tools, cycles, motor-cars and aircraft, electrical and general engineering machinery, rayon, textiles, and pottery.

Chief Towns. The county town is Warwick (population 13,459) (which see). Birmingham, Coventry, Kenilworth, Leamington Spa, Nuneaton, Rugby, and Stratford-on-Avon are dealt with in separate articles.

Other towns include—

Atherstone (population 21,940) is on the highway known as Watling Street, close to the Leicestershire border. It bears evidence of very early occupation, and as Aderstone is mentioned in Domesday Book.

The making of felt hats is the chief industry. Its seven centuries old market is an important weekly event.

Solihull (population 40,000) is an Urban District near Birmingham which has a history going back to King John. It contains many ancient buildings, including the parish church of St. Alpage (thirteenth century).

Sutton Coldfield (population 33,110), adjoining Birmingham, is the second oldest town in the county. In Saxon days it was owned by Mercian kings. It is now a health resort and residential town, and owns an extensive park.

WASHINGTON. The most north-westerly State of the American Union, situated on the Canadian frontier, with an area of 69,127 sq. miles, of which 2291 sq. miles are water. In 1930 the population was 1,563,396. Over half of the total number of inhabitants live in towns or cities with a population of 2500 or more. The three great cities of the State—Seattle, with 365,583 inhabitants (Federal census), Spokane, and Tacoma, each with less than 120,000—contain more than one-third of the entire population. Other important cities are Bellingham, Everett, Yakima, Aberdeen, Vancouver, and Olympia (the capital).

The State is divided by the Cascade Mountains into two unequal sections, the highest peak is Mount Rainier with an altitude of 14,408 ft. The west is penetrated in the north for over 100 miles by Puget Sound, which, with its deeply cut inlets, forms one of the finest harbour systems in the world. The fertile, rolling fields of this valley, lying scarcely above sea-level, merge into the wooded foothills of the Coast Range on the west. Mount Olympus, rising to an elevation of 8150 ft., is the highest point in this range. The eastern half of the State contains the great Columbia plateau, treeless but fertile, where the main industry is agriculture. The Grand Coulee dam will irrigate part of this region.

Wheat and hay in the east; oats, barley, fruit, and vegetables in the west, are the principal products.

The greatest recent agricultural development has been in fruit culture, and Washington is becoming one of the Union's leading fruit-growing States.

The grassy slopes in the Cascades are the summer pastures of large herds of cattle and sheep. However, the mild winters and rich grasslands of Western Washington make dairying important in that section. The poultry industry is important.

In timber production Washington is the most prolific of the American States; its rich forests of pine, spruce, hemlock, and fir have contributed greatly to its prosperity.

Moreover its deposits of coal, gold, silver, copper, and lead give employment to many thousands. Timber goods and paper are the most important manufactured products. Printing and publishing, engineering and food preserving are also carried on.

WASHINGTON CONFERENCE. See DISARMAMENT.

WASHINGTON, D.C. The capital city of the United States with a population in 1930 of 486,869. It is situated on the Potomac River, about a hundred miles from its mouth, and is 38 miles and 135 miles south-west of Baltimore and Philadelphia, respectively. The town is built on the systematic lines devised by the French engineer, Major Charles L'Enfant, the main streets all radiating from the Capitol building.

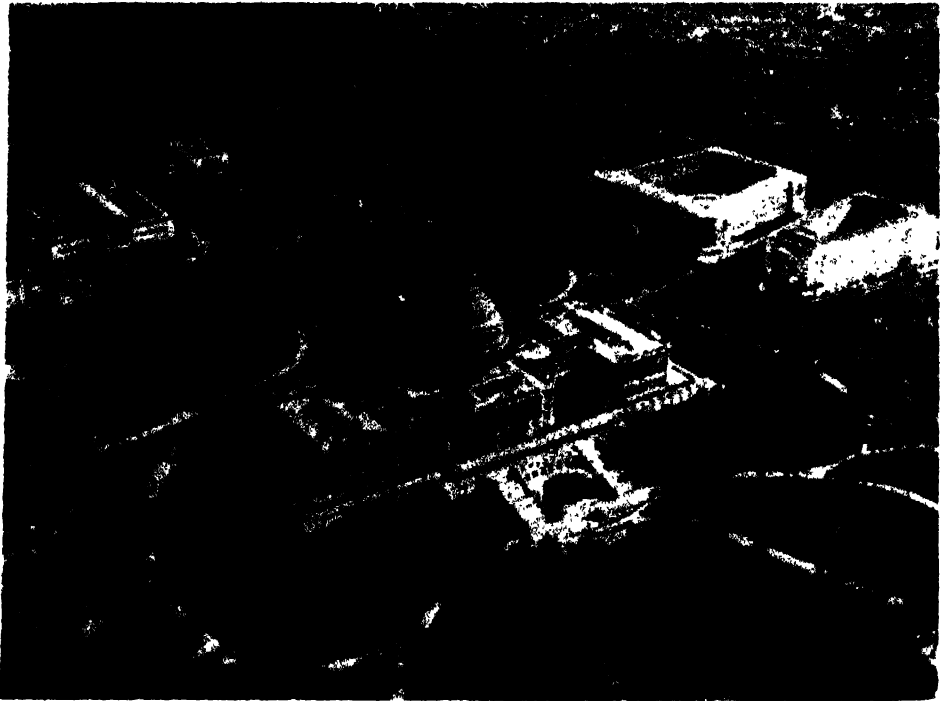
The most conspicuous building is the white dome of the Capitol, crowned by a bronze statue of Freedom. Within are the richly decorated chambers of the Supreme Court and the Senate, where Congress was first held in 1800.

Rivalling the Capitol in interest is the official home of the President, the Executive Mansion, popularly known as the White House.

The Washington Monument, the Lincoln Memorial, and the various offices of the State department are all modern buildings; some have beauty, others are but poor adaptations of classical styles.

Although Washington is first and foremost the administrative and executive centre of the United States, the lighter types of manufactures are playing a part of increasing importance in the economic life of the city. Washington now manufactures annually, in its metropolitan area, products valued at over £20,000,000.

WASHINGTON, GEORGE (1732-1799). American soldier and statesman, first President of the United States of America. He was descended from the English family of Washingtons of Sulgrave Manor, Northamptonshire. George Washington was born near Pope's Creek in Westmoreland County, Virginia. His education though sound was not advanced and at 16 he became a surveyor. He was helped in his profession by Lord Fairfax, with whose family his own was connected by marriage, and in 1748 he was given the task of surveying the Fairfax estates. In 1753, as Adjutant-General of Militia, he was entrusted with a military



WASHINGTON: PART OF THE CAPITOL HILL AREA

1. The Capitol. 2. Supreme Court Building. 3. Folger Shakespeare Library. 4. Library of Congress.
5. House of Representatives Office Building. 6. House Office Building Annex.

mission to the French to warn them not to cross the frontier.

In 1755 Washington was General Braddock's second in command when the British forces unsuccessfully attacked Fort Duquesne. Washington's masterly handling of beaten troops after the fall of Braddock enhanced his reputation.

In the meantime his wealth and position in the colony had grown considerably.

During the critical decade beginning in 1765, Washington spoke little on public matters, but by his actions showed that he supported the colonial demands. In 1774 he broke his silence and demanded self-government for the colonies, or armed

rebellion. He represented Virginia at the First Continental Congress. At the second Congress of 1776 he was appointed Commander-in-chief of the American forces. It was an army only in name, 14,000 raw volunteers without training or discipline, or proper supplies. The manner in which Washington welded these ill-organized units into a successful army is now history. See AMERICAN REVOLUTION.

In 1787 Washington was elected President of the United States. It was fortunate that America could call on such a man to take office, for he gave to the position a prestige which it has never quite lost.

In 1793 he was re-elected to the Presidency, and showed his strength of will when he resisted all attempts to draw America into the war then being waged between Britain and France. At the end of his second term, Washington returned to his home, Mount Vernon, and busied himself with his estate. See UNITED STATES.

WASP. A stinging insect which belongs to the same order as bees and ants, all of which are characterized by their highly developed instinctive behaviour. The order to which they belong is called *Hymenoptera*, meaning membrane-winged. The abdomen is joined to the front part of the body by a very narrow "waist." In almost all cases wasps are brightly coloured; the common British wasp has black and yellow cross bands. Wasps are world wide in their distribution, but are represented by greater

varieties of form in tropical regions. They are divided into several distinct groups.

The Digging-wasps are large in size and found mainly in the tropics. One species is found in Britain, though not very commonly. This wasp digs a hole in the ground and lays an egg beside a store of food consisting of a caterpillar or spider, which has been paralysed by being stung. In this way the young grub has a store of fresh food during its development.

The true wasps, which can be distinguished from the digging group by the fact that they fold their wings longitudinally, are divided into two main sections, the Solitary and Social wasps. Several species of these are found in Britain. There is a solitary wasp which builds a small clay "nest" on a heather stem and suspends its egg over a store of paralysed insects. Included in this division also are the Mason wasps, some of which burrow in the ground and others in walls. In the latter the nest usually contains several cells with an egg in each.

The common wasp belongs to the social group. Like the ants and bees they consist of a community in which there is a division of labour. This means that the community is divided into sections which perform different duties. In the common wasp it is only the female that survives the winter.



GEORGE WASHINGTON

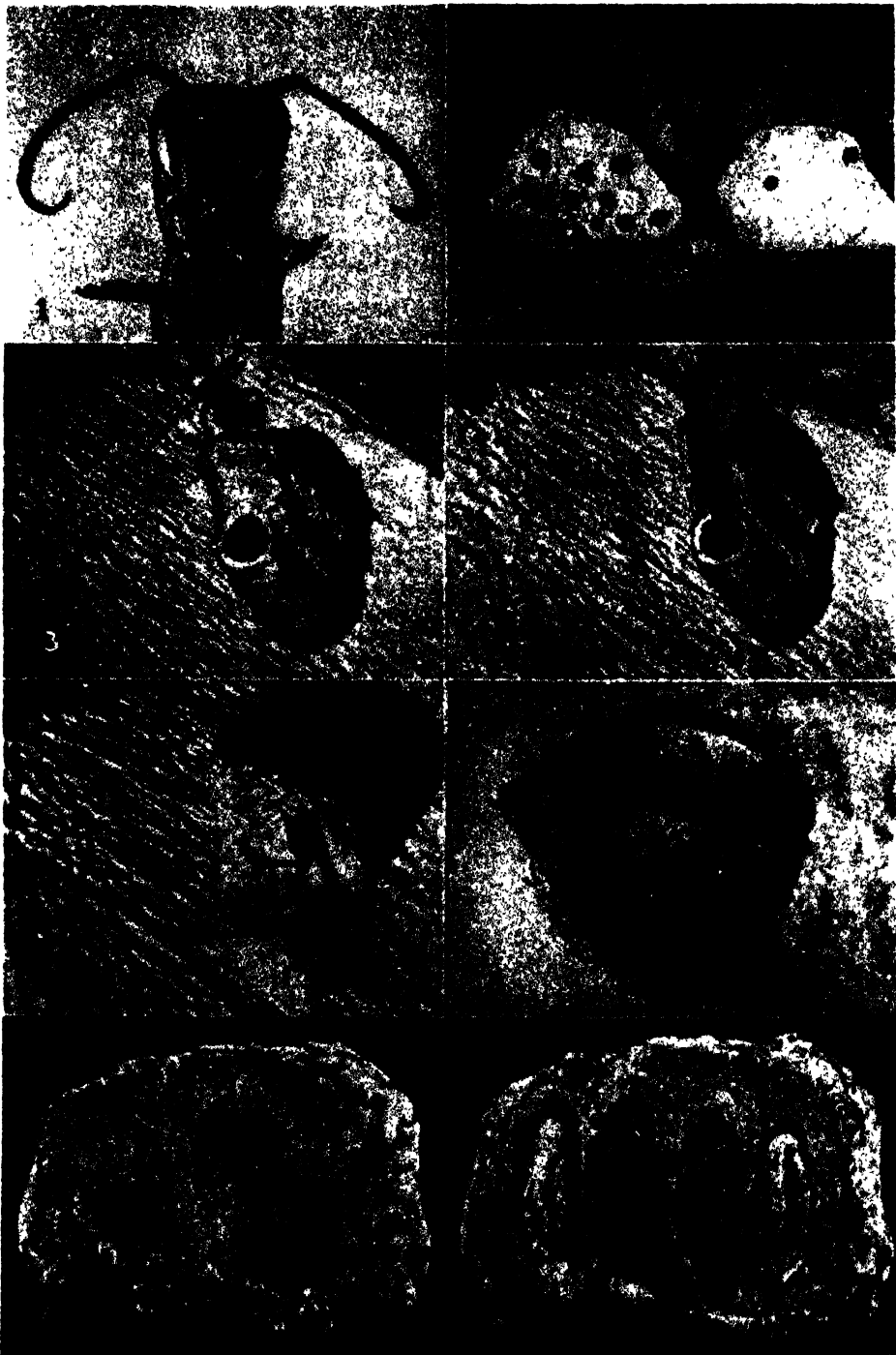


WASPS' NEST

Built inside a beehive it is a six-tier structure, 16 in. across. It was found at St. John's College, Cambridge.

Photo: Eastern Press Agency

In the spring she builds a small nest of paper produced from masticated wood. A number of cells are made and an egg laid in each. The young grubs develop, and eventually emerge as females which are not capable of reproducing. They are workers and take over the duty of enlarging the nest and feeding the next brood of grubs. The original



THE WASP

1. A "close up" of the head of a wasp. 2. An old nest. 3. Wasp carrying a load of mud, shaped for a cell of the nest. 4. Placing a new cell in position. 5. A cell under construction. 6. A completed nest. 7. Close view of a nest. 8. Interior of a nest.

female, corresponding to the queen in the bee-hive, has only to lay the eggs. At the end of the year fully developed males and females are produced. When food becomes scarce any grubs that are still there are killed and eaten and the nest is deserted. All die except a few females which have mated.

Scientific Name. Both solitary and social wasps belong to the family *Vespidæ*. The common wasp is *Vespa vulgaris*.

WASSAIL. To "keep wassail" is to indulge in festive celebrations which take the form of jovial meetings where there is much hilarity and carousing. Many festival occasions in the Middle Ages could have borne the description, but the word does not appear to have been then used. In 1648 there are records of wassail gatherings where the toasts included fruit trees and cattle, the desire being to express and if possible to influence the production of good harvests and stock. "Wassailing the Apple Trees" was in the seventeenth and eighteenth centuries a regular Christmas custom.

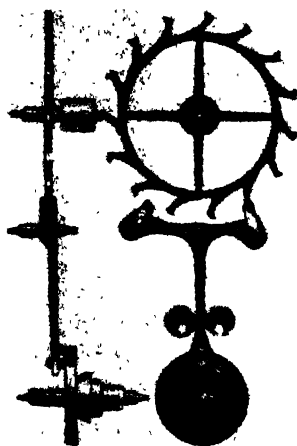
WATCH. A portable instrument for measuring time, possibly invented about the year 1500 by Peter Henlein, or Hele, a locksmith of Nuremberg, Germany.

Development of the Watch. As the first essential of a watch is portability—that is, it must be small and must run correctly when being carried in any position—the early clockmaker who set out to make such a timepiece was confronted by two great difficulties: first, all the parts had to be made by hand; second, a new motive power had to be found, for a weight could only be used in a clock, which always stood erect. The first difficulty was soon overcome by training skilled watchmakers, and the second by the invention of the mainspring, about the year 1500. At first, a straight spring was used, but this soon gave way to a coiled spring.

Enamel dials made their appearance in 1650, the coiled hairspring as applied to the balance wheel about 1658, the minute hand and its mechanism in 1687, and a century later the helical balance spring and the second hand. About 1700, it was discovered that garnet, ruby, and other precious stones, though costly, made the best pivot bearings. All high-grade watches now have "jewelled movements."

Mechanism. The works, commonly called the *movement*, consist of a train of wheels, the spring which turns them, and the escapement which regulates their speed. The train of wheels operates on the same principle as the wheels of a clock. The second hand is attached to a wheel which revolves once a minute, the minute hand to one revolving once an hour, and the hour hand to one

revolving once in twelve hours. These various wheels are connected by pinions, as shown in the illustration, the number of teeth on the pinion and on the wheel is arranged to give the proper number of revolutions. The largest of the wheels, known as the barrel, contains the mainspring, whose unwinding turns the barrel. The barrel is connected with the stem-winding device. A little click or tooth catches the teeth of the ratchet on the barrel and prevents it from slipping. At the other end of the train is the escapement, consisting of the escape wheel, the pallet, the fork,



MECHANISM OF THE ESCAPEMENT

roller and roller pin, balance wheel, and hairspring. This device controls the movement of the whole train of wheels, and it therefore takes the place of the pendulum in a clock.

The escape wheel has fifteen hooks, or teeth. The pallet is an anchor-like piece, with two horns so shaped that first one and then the other grips a tooth of the escape wheel. These horns allow only one tooth at a time to slip by. The pallet is fastened to a fork, which in turn is fastened to the balance wheel by means of a small disc called the roller. The roller pin alternately holds and releases the fork, thus allowing the escape wheel to turn, and setting the entire train of wheels in motion. The balance wheel is made so that it balances perfectly, its weight being equally distributed throughout its circumference. The tiny screws on its rim are put in for this purpose, and also to give the weight necessary for 18,000 vibrations an hour. The motion of the balance wheel is controlled by a fine hairspring of steel, which is fastened to the balance wheel.

In most modern watches, the tension in the hairspring can be regulated by a small lever. The entire movement of a watch is set between two metal plates, usually of brass, to which the wheels are attached.

Watch Manufacture. The making of watches by hand seems to have originated in Germany about the year 1504. In that country, in Switzerland, and in England, it received its highest development during the next three centuries. Good watches were also made in France and Italy. About the beginning of the nineteenth century, several attempts were made to establish a watch-making industry in the United States. Fifty years later, the invention of machines for making the parts of watches gave opportunity for the institution of a large industry devoted to the manufacture of cheap watches and clocks. The largest factories in America are at Waltham, Massachusetts, and Elgin, Illinois. Cheap watches have had considerable vogue, and serve a useful purpose under some conditions. The parts are all stamped out with dies; no jewels are used, and little attempt is made to regulate the movement or to adjust the parts. These watches often keep good time, but if any trouble develops, it is almost useless to attempt repairs.

WATCHES, SHIP. In the Royal Navy and Merchant Service, the term *watch* is applied both to divisions of the ship's company and also to the periods into which the day is divided to mark the duration of the watches. It originated in the days of sail when the seamen were divided into two watches, *star-board* and *port*, which kept the deck alternately. In the Navy some captains prefer to organize their ships on the *three watch* system, under which the watches are designated *red*, *white*, and *blue*. In the Navy, also, the watches are further subdivided into *parts* and *subdivisions*.

The periods of the several watches into which the day is divided are: Middle Watch, midnight to 4.0 a.m.; Morning Watch, 4.0 a.m. to 8.0 a.m.; Forenoon Watch, 8.0 a.m. to noon; Afternoon Watch, noon to 4.0 p.m.; First Dog Watch, 4.0 p.m. to 6.0 p.m.; Last Dog Watch, 6.0 p.m. to 8.0 p.m.; First Watch, 8.0 p.m. to midnight.

Connected with the division of the day into watches is the sea custom of marking the hours by striking the bell. Thus the end of the first half hour in each watch (i.e. 12.30 a.m., 4.30 a.m., 8.30 a.m., 12.30 p.m., 4.30 p.m., 6.30 p.m., and 8.30 p.m.) is indicated by one stroke, the end of the first hour (1.0 p.m., 5.0 p.m., 7.0 p.m., and 9.0 p.m.) by two strokes, and so on, adding one stroke for each half hour up to the end of the watch, which is indicated by eight bells (midnight, noon, 4.0 p.m., and 8.0 p.m. It

will be observed that a special rule applies in the last dog watch, where 6.30 p.m. is marked by one bell, while the corresponding hour in the forenoon is indicated by five bells. This special arrangement applies all through this watch, except that at the end of the watch eight bells are struck. There is also a very old custom whereby sixteen bells are struck at midnight on 31st December, to mark the passing of the old year.

WATER. A liquid which covers five-sevenths of the whole earth and is one of the most necessary substances for the maintenance of all life. It sprouts the seeds and feeds plants and animals; and without it, man would die of hunger as well as of thirst. It has been confined by man and pressed into service to furnish power for his mills and steam for his engines. It is estimated that from 15 to 50 gal. a day are used for personal purposes for each person in civilized States.

Water is a compound of two volumes of hydrogen and one volume of oxygen. Hence it is represented in chemistry by the formula H_2O . By weight, it consists of two parts of hydrogen and sixteen parts of oxygen. When perfectly pure, water is colourless, tasteless, and odourless, but all natural waters contain impurities.

Water is said to be *hard* or *soft* according to the amount of bicarbonate of lime and magnesium salts in solution. The hardest waters are obtained from wells, lakes, and some streams. Soft waters are preferable for washing purposes, since they more readily dissolve the soap, but the hard water is better for drinking.

Absolutely pure water is probably unknown. Chemically pure water for laboratory use is difficult to prepare. The purest water ordinarily obtainable is obtained by distillation, which leaves all solid impurities in the still.

Physical Properties. Although water is commonly spoken of as a liquid, it exists also in solid and gaseous forms. Water vapour is a normal component of the atmosphere, and when as much water has evaporated into the air as it is possible for it to hold, the atmosphere is said to be saturated. Under ordinary atmospheric pressure, pure water boils at 212° F. (100° C.), and solidifies at 32° F. (0° C.). On mountain tops, where there is little air pressure, water boils at lower temperatures, and may reach a much lower temperature than 32° F. without freezing. See THERMOMETER; HEAT.

Another feature of water, important in physiography, is its exception to the general law of expansion by heat. It is at its greatest density at 39.2° F. (4° C.), when one cubic centimeter weighs one gramme. When heated

from the freezing point, it contracts until it reaches 39.2° F., after which it expands. Conversely, when cooled from 212° F., it contracts until it reaches 39.2° F., when it again begins to expand. This expansion causes the bursting of water pipes and containers in freezing weather.

WATER BEETLE. The name covers several distinct families of beetles which inhabit the water. Some live permanent aquatic lives,

and others live in or near the water only while in the larval (young) state. Typical examples of water beetles are the *whirligigs*, the *diving beetles*, and the *common water beetles* of the ponds. Whirligigs dance and whirl on the water, they have short antennae, long, clawed front legs, paddle-shaped hind legs, and compound eyes, adjusted for vision above and below the water.



WATER BEETLE.
Photo. Visual Education Service

Diving beetles are distinguished by their long, threadlike antennae and flattened, fringed hind legs, fitted for swimming. The common water beetles have short, club-shaped antennae, and resemble the diving beetles in their habit of feeding on small fish and larvae, in common with the whirligigs, they have a receptacle for carrying air when diving into the water.

WATER BUCK. A large antelope. Distinguishing features are a white ring on the

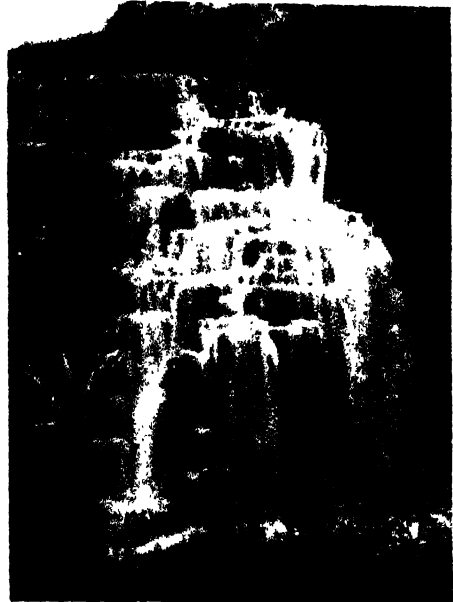


MALE AND FEMALE WATER BUCK
Photo: Cherry Kearton

buttocks and the ringed horns of the male. It is a native of Africa.

Scientific Name. The water buck is *Cobus ellipsiprymnus*.

WATER CLOCK, OR CLEPSYDRA, *klep'sid ra*. An instrument for measuring time by means of water escaping from a vessel. It was used long before modern clocks were invented. It was usually in the form of a glass jar, with a scale of markings on its side so arranged that, as the water ran out, that which remained in the jar marked the time. Various improvements were made in the device, such as having a floating figure point



UNLASS FALL, NATAL
Photo. South African Railways

to the hour. The water clock was used in Rome as early as 150 B.C., and it was employed in Athens to regulate the length of speeches in the law courts.

WATER COLOURS. Certain pigments prepared for the use of artists, and made by mixing colouring-matter, which has been ground to a fine powder, with water and a gum size or other adhesive substance. They are applied with a wet brush. Their rapid drying qualities make them convenient for out-of-door use. It was not until the nineteenth century, in England, that water-colour painting first really became a rival of oil painting, and its true scope and power were revealed.

WATERCRESS. See **CRESS**.

WATERFALL. The sudden descent of a stream from a higher to a lower level. In wearing down its channel, a river uncovers certain layers of rock that are softer than others. If the hard rock is farther upstream than the soft, the channel below is worn

more rapidly, and a cascade or rapid is the result. The occurrence of a waterfall may thus be said to be due to abrupt changes in geological structure. Sometimes the hard ledge forms the margin of a vertical cliff, over which the water plunges. If the volume of water is large, a fall of this sort is called a *cataract*; if the volume is small, the fall may be called a *cascade*. Ordinarily, the term *cataract* is applied to a series of rapids or falls caused by the flow of the stream over a rapidly sloping rocky bed. Cataracts with a small, gradual fall are termed *rapids*.

WATERFORD. A cathedral city and port, and the capital of the county of Waterford in the Irish Free State, with a population of



WATER LILIES IN CENTRAL AFRICA

Photo: Cherry Kearton

26,647. The city has two cathedrals—Christ Church Cathedral, dated 1779 but founded about 1050, and the Catholic Cathedral, erected in 1793. The Danes are said to have founded Waterford about the middle of the second century A.D. Reginald's Tower, stated to have been built in 1003, was later used as a fortress, and now remains an outstanding monument of Danish Waterford. The industries include shipping, bacon curing, brewing, boot manufacture, and dairy farming.

WATER LILY, OR POND LILY. Popular names for certain water plants, found throughout temperate and tropical climates. From the mud of clear, shallow water these plants send their long, stout stems, while above the water may be seen the green leaves and cup-shaped flowers. To most people, the white blossom only is known, but there are water lilies of pink, red, yellow, and lavender-blue. The leaves are round or oval, and are from 2 in. to over 1 ft. in diameter, and they float on the water. The flowers may be as small as one-twelfth of an inch, or as large as a foot across.

Scientific name. Water lilies belong to the family *Nymphaeaceae*.

WATERLOO, BATTLE OF. The battle that resulted in the retirement of Napoleon from European affairs and his banishment to the rocky islet of St. Helena. It was fought on 18th June, 1815, near Waterloo, a Belgian village lying about 10 miles south-east of Brussels.

Wellington had fallen back towards Waterloo after two preliminary engagements on the 16th. The Prussians under Blücher had been defeated at Ligny, and Wellington's efforts to effect a junction with his allies had been frustrated by Marshal Ney. He therefore retired and drew up his forces near Waterloo. On the 18th, the French were seen to occupy a series of heights opposite, across a shallow valley from 500 to 800 yards in breadth.

The forces under Wellington numbered 67,600 men, with 156 guns. The French army was 74,000 men, with 246 guns. After a prolonged engagement the victory for the allied troops was hastened by the arrival of General Blücher who had rallied his men earlier than expected.

WATERMELON. A fruit known from the earliest times and cultivated for its pulp. The watermelon was originally found in tropical and Southern Africa, but is now grown as far north as Canada. It is grown from seed and thrives in light, sandy loam, well drained, well fertilized, and unshaded.

A melon usually weighs from 20 lb. to 50 lb.

Scientific Name. Watermelons belong to the gourd family, *Cucurbitaceae*, and to the genus *Citrullus*.

WATER PLANTS, OR AQUATIC, a kwat' ik, PLANTS. These names do not refer to any special botanical group, but to many different species of plants that live wholly or partly in water. The term *aquatic* as ordinarily used refers to such seed-bearing plants as grow in water, and does not include the algae (which see).

WATER POLO. See POLO.

WATER POWER. In engineering, the power obtained from a fall or current of water, employed as energy. In spite of the heavy capital outlay of damming a river and constructing canals to carry the water to the wheels, water power is often less costly than a corresponding steam power.

Theoretically, water falling from a higher to a lower level exerts a power equal to the weight of a column of water as high as the distance from one level to the other. To illustrate: a cubic foot of water weighs 62.5 lb.; therefore a column of water 2 ft. in width, 1 ft. from front to back, and 10 ft. high would weigh 1250 lb., and at its base it



HYDRO-ELECTRIC POWER PLANT UNDER CONSTRUCTION

Under the Grid System of electric power supply immense plant is being laid down. Under the Lochaber scheme the waters of six lochs will be brought together to feed a 100,000 h.p. station at Fort William. When complete the Laggan dam (1) will hold back a reservoir eleven miles in length. (2) A section of the steel pipe-line to the power house. (3) The outlet end of the tunnel connecting Lochs Laggan and Freig. (4) General view of construction work in progress at Earlstoun. (5) The pipe lines at Tunnel Bridge. These are 12½ ft. in diameter—1 ft. greater than the tunnels of London's underground railways. (6) A section of the work in progress at Ben Nevis.

Photo: Fox

would exert a pressure of 1250 lb. If this water is allowed to flow against the buckets of a water wheel, it will cause the wheel to revolve with sufficient force to operate light machinery. The actual power developed, however, is always less than that theoretically estimated. Some power is lost by friction of the water on the conduit, and some by failure of the wheel to utilize all power exerted by the water. Rapidly flowing streams are the most convenient source of water power. The plant at the Niagara Falls is sufficient for most of the industrial purposes of the city of Buffalo, including power for the city's tramway system.

The horse power—a force that will raise 33,000 lb. 1 ft. in 1 min., or 550 lb. 1 ft. in

10 ft. to 5000 ft., with a high degree of efficiency, by means of an inexpensive form of electric generator. High-tension transmission at pressures up to 220,000 volts has also become practicable, so that the energy can be transmitted efficiently for considerable distances, even as far as 200 or 300 miles. It has therefore become commercially possible to develop large water powers at points far distant from industrial centres, and to transmit the energy as needed.

The abnormal requirements of the World War period were responsible for a great rate of hydro-electric development in many countries, especially in France, Italy, and Canada. France has 3,800,000 water horse power, having very largely increased the supply since 1914. Italy has 6,000,000, and Canada 7,500,000. Apart from numerous industrial enterprises, most of the trunk lines of the American, Swiss, Italian, and Japanese railways which have so far been electrified are worked off hydro-electric power.

The potential water power of Europe is estimated at 100,000,000 h.p., but less than 20 per cent of the potential power is now in use. The potential water power of the U.S.A. and Canada is 124,000,000, the former having a potentiality of 80,000,000.

The potential water power of Asia is 71,000,000 h.p., and that of Africa is 190,000,000 h.p. South America has an estimate of 44,000,000 h.p., and the British Empire, outside of Canada, has an estimated supply of 60,000,000. It thus appears that the available water power of the world is approximately 447,000,000 h.p., of which about 52,000,000 h.p. was developed up to 1934.

WATERPROOFING. A method of treating cloth, leather, wood, and other substances, so that they will shed water. One method consists of treating the material with a solution of rubber or boiled linseed oil, paraffin wax or varnish. In another process, the yarns are similarly treated before they are woven. A third process consists in treating cloth with a solution of rubber, so that, in the finished product, the layer that turns the water lies on the under surface of cloth. The mackintosh is thus made.

Waterproof paper umbrellas are made in Japan by dipping paper in a solution of potassium dichromate and glue. In certain countries, a solution of shellac in borax is substituted. Leather is treated in a bath of hot, melted paraffin.



WATERSHED
Mourne Mountains, Ireland.

Photo: H. E. Taylor

1 sec.—is the unit employed in measuring water power. To estimate the horse power of a waterfall or rapid, multiply the flow in cubic feet per second by the height of the fall in feet, and this product by .1134. According to this rule, a fall 50 ft. high and having a flow of 500 cub. ft. per second would develop $50 \times 500 \times .1134$, or 2835 h.p.

Plants are sometimes built in mountainous regions, where dams for impounding the water of small streams are constructed at levels from several hundred feet to thousands of feet above the location of the wheels, to which the water is conducted by iron pipes. Power plants of this type have a high head and generally a small volume of water. Height of the head compensates for the volume of water, but such plants require a special type of water wheel. The plant installed in the Snowdon range in Wales is of this type.

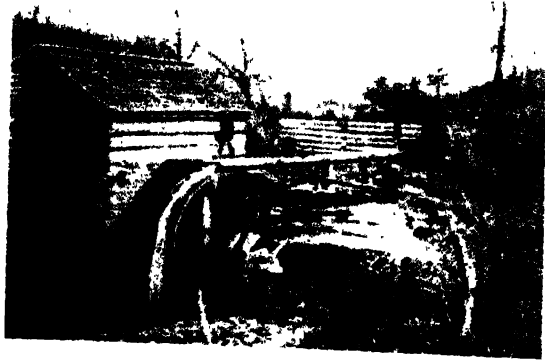
Hydro-Electric Power. By means of the hydraulic turbine (see **TURBINE**), it is possible to utilize any head of water, from

WATERSHED. A height of land which separates the headwaters of one river system from another. It is also called a *divide*. See RIVER.

WATER SPOUT. A whirling column of air extending from a cloud to the surface of lake or ocean, rendered visible by the water or vapour it carries. A waterspout is caused by a strong upward current of air under a cloud. The air acquires a rapid rotary motion as it ascends, and an area of low pressure is produced in the centre. Humid air rushing into this low-pressure area is rapidly cooled and becomes visible as vapour. Thus, although waterspouts may draw up some water from the sea near their base, the greater part of the water they contain is fresh water.

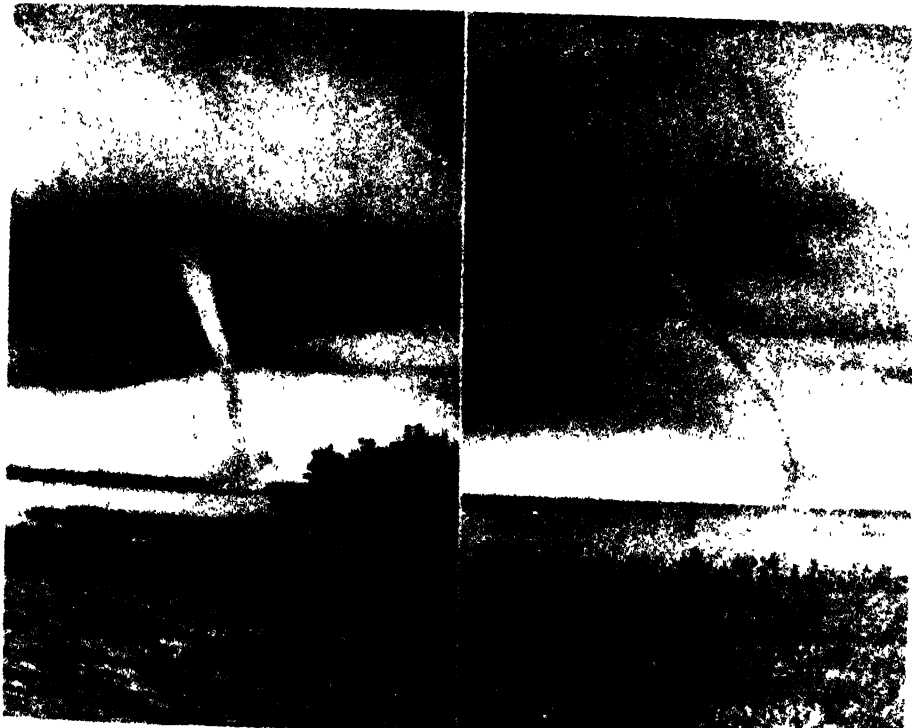
WATER WHEEL. A device for utilizing the power of falling water for mechanical purposes. The water is guided from a stream or overflow sluice to the wheel by means of a chute, so that it exerts its force chiefly by its weight,

and partly by impact. The wheel revolves on a horizontal axle which is connected by



AN OLD MILL WHEEL
Photo. Visual Education Service

belts or gearing with whatever machinery it is intended to operate



WATER SPOUTS

Left. Waterspout on Jackfish Lake, Saskatchewan, near North Battleford in 1923
Right: Waterspout on Lake Erie, near Lorain, Ohio, in 1919

WATERWORKS. The maintenance of a supply of pure water is an essential feature of modern civilized life, for large communities would soon be ravaged by disease if the supply of water failed or became polluted. The main sources of water are moorland waters and lakes, rivers, and springs and wells.

Moorland Waters and Lakes. These sources are naturally used by towns situated fairly near to hills. Thus Blackburn, Halifax, and Huddersfield depend on moorland reservoirs,

Moorland waters are often acid, due to the water being in contact with peat, bilberries, and heather. Acid waters will dissolve lead from pipes and so cause lead-poisoning. Specially acid streams should be diverted from the reservoir and the water neutralized with lime if necessary.

Rivers and Streams. Many towns take their water from rivers. Most of London's water comes from the Thames and Lea, while Reading takes its water from the Kennet, and Shrewsbury, Worcester, and



WATERWORKS

1. Reservoir and treatment tanks at Chelmsford. 2. The engine room at Chelmsford. In the foreground are pressure filters. 3. General view in the pumping station at Keinton Park which was opened in 1934.

Photos. Topical; Central

while Liverpool is supplied from Lake Vyrnwy and Manchester from Lake Thirlmere. If the reservoirs and lakes are high enough, the water will flow to the towns by gravity and the expense of pumping will be avoided.

In selecting the site of the proposed reservoir, the ground should be carefully surveyed for possible sources of pollution. These are likely to be drains and cesspools of farms and manured fields. Drainage should be arranged to avoid surface water getting into the reservoir, and the outlet to the reservoir should be made so that all water is stored as long as possible. The outlet should not be near any of the inlet streams, otherwise in times of flood impurities will be washed into the reservoir and be drawn out through the pipe before they have had time to settle.

Cheltenham from the Severn. River water is likely to be polluted by sewers and factories. Pollution should be stopped as far as possible, but river water can be made as pure as moorland water by storage and filtration through sand. Water should not be taken into the reservoirs in time of flood when the impurities are highest. The necessary storage time can be much reduced by the addition of lime or by chlorination. Chlorination was first used in England at Reading in 1910. Sufficient chlorine is added from cylinders to kill all harmful bacteria and the excess removed by filtering through charcoal.

Springs and Wells. These are the usual sources of supply in the country, though large towns such as Birkenhead, Southampton, Wolverhampton, and Portsmouth take

much of their water from springs and wells. The source of spring water should be determined as far as possible by geological examination. If pollution at a certain spot is suspected, it may be tested by washing salt or a harmless dye into the ground and seeing whether the spring is affected. Wells should be as deep as possible and protected from contamination by surface water. Pollution of shallow wells in the country is particularly likely from defective drains or manured fields.

Examination of Water. Apart from the presence of lead, the chief danger to health in water lies in the presence of bacteria from decaying organic matter and sewage, which can cause typhoid fever, cholera, dysentery, and other diseases. *B. coli* is the most persistent bacteria found in sewage, and if this is absent the other harmful bacteria are likely to be absent too. Chemical analysis is made for chlorine, nitrates, and ammonia. These are perfectly harmless in themselves, but their presence usually indicates that the water has at some time been in contact with decaying animal or vegetable matter, though they may be present from other causes. To draw the correct inferences from a water analysis requires the greatest skill and experience, and the sources of supply and possible contamination should always be taken into account.

WATFORD. A Municipal Borough and market town of Hertfordshire with an area of 3251 acres and a population of 56,709 in 1931. Situated within 20 miles of London, it is the largest and commercially the most important town in the county. In history the manors of Watford and Cassio have been closely associated, probably of Anglo-Saxon origin—Cassio is unlikely to be derived from the name of the British chieftain Cassivelaunus, as many have supposed. From the eighth to the sixteenth centuries both Cassio and Watford were in the possession of the Abbots of St. Albans, to whom they were given by Offa, King of Mercia, in 757. Later they passed into the hands of the Earls of Essex. Always dominated by St. Albans, Watford began its career of prosperity in the last century and has increased apace with a largely residential population. Markets have been held almost continuously since the first Charter was granted to the town by Henry I. The parish church of St. Mary dates from the twelfth century, but was much restored in 1871. Another building of interest is the Free School, a good example of the Queen Anne Style.

WATSON, SIR WILLIAM (1858-1935). English poet born in Liverpool; he published his first book in 1880. Ten years later his "Wordsworth's Grave" attracted attention

and his reputation steadily grew. "Lacrymae Musarum," "The Father of the Forest," "For England," and other poems followed. He was knighted in 1917. He had acquired renown, but he did not command a large circle of readers, his thoughtful, dignified work being too emotionless to make a wide appeal.

WATT. In electricity, this is a unit for measuring power, or the rate at which the current works. A watt is equal to the pressure of 1 volt, with a flow of 1 ampere. The kilowatt, 1000 watts, is the unit usually employed; 746 watts equal 1 h.p. See HORSE-POWER.

WATT, JAMES (1736-1819). A Scottish engineer generally credited with the invention of the steam engine; he was born at Greenock. Owing to his precarious health, the boy was educated at home. At the age of 19, he was apprenticed to a mathematical instrument maker in London, but returned to Scotland after a year and set up in business for himself, supplying instruments to the University of Glasgow. It was while he was engaged upon the repair of a model of John Newcomen's steam-engine that he became aware of its imperfections, particularly the waste of power that took place. A series of inventions of the greatest importance followed: the separate condenser, the flywheel, the governor, and others. Watt went into partnership with Roebuck and afterwards with Boulton for the exploitation of his patents. His steam engine was used at first chiefly in draining mines. Other inventions made by Watt included copying-ink and the screw-propeller. He was interested in chemistry and discovered the composition of water. He carried out many surveys on canals and harbours.



JAMES WATT
Photo U. & L.

WATTEAU, vah lô, ANTOINE (1684-1721). A French painter who was without an equal in his day in the portrayal of the manners, graces, and dress of fashionable society. He interpreted with wonderful skill the spirit of court life during the reign of Louis XIV.

WATTLE. A name given in Australia and Africa to various species of trees and shrubs belonging to the *Acacia* genus. The leaf and flower form is the same as the mimosa (which

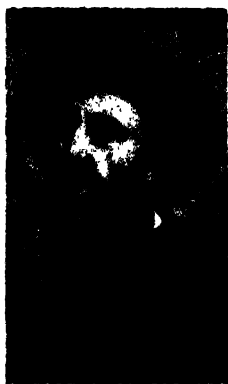


see). The wattles have a considerable economic value. One variety yields gum arabic, and the bark of several kinds yields tannin which is used in the preparation of leather.

Scientific Name. Wattles belong to the subfamily *Mimosaceae* and the family *Leguminosae*.

WATTS, GEORGE FREDERICK (1817-1904). An English artist best known for his work in portraiture and the portrayal of religious subjects. "Watchman, What of the Night?" "Life's Illusions," "Love and Death," "Hope," etc., are among his most

notable symbolical canvases. His historical paintings, landscapes, and numerous sculptural pieces were conceived on the same lofty plane as were his symbolical studies.



G. F. WATTS
Photo: Brown Bros.

Watts was born in London, studied for a time at the Royal Academy schools, and in 1843 a prize in a competition enabled him to travel in Italy, where he gained much from his study of the old Venetian masters. In 1864 he married Ellen Terry, the English actress, then only 16 years of age, who was the model for "Sir Galahad," which Watts presented to Eton College.

Watts gave over 150 portraits, including those of Carlyle, Tennyson, Matthew Arnold, Browning, Millais, and Leighton, to the National Portrait Gallery.

WATTS, ISAAC (1674-1748). English preacher and hymn-writer, born at Southampton. In 1702 he became minister of the Independent Church in Mark Lane, London. After a serious illness in 1712, he went to Abney Park, the estate of Sir Thomas Abney, at Theobalds, and made that place his home for the remainder of his life. He wrote many theological works in addition to composing a number of the most popular hymns.



ISAAC WATTS
Photo: Brown Bros.

"Jesus Shall Reign Where'er the Sun"; "O God, Our Help in Ages Past"; and "There Is a Land of Pure Delight" are among those best known.

WAVE-LENGTH. See **LIGHT**, **WIRELESS**.

WAVES. Undulating disturbances passing from particle to particle throughout an elastic substance. The most familiar form of wave is that seen on the surface of a body of water. Such waves are produced by the friction of the wind. The wind, in its passage, lifts separate particles of water, which the pull of gravitation draws back again. Thus, they are caused to vibrate rhythmically. To the eye, it seems that the water moves forward, but this is not true. The separate particles of water, instead of advancing with the advancing wave, simply rise and fall on the same spot. Sound, heat and light are propagated in waves that are invisible and are known only by their results.

WAX. A solid, easily melted substance obtained from various animal, vegetable, and mineral sources, and used extensively for commercial purposes. The most common variety is *beeswax*, secreted and used by insects to build their cells. *Paraffin wax* is obtained from the distillation of petroleum. *Spermaceti*, extracted from the oil taken

from the sperm whale, is largely used as an ingredient in toilet creams.

WAXWING. A bird belonging to the Arctic regions of the Old and New World. There are different species in Europe, Asia, and North America, the last named being generally known as the cedar-bird or cedar-waxwing.

Waxwings are about the size of a hawk-finch; the plumage is silky in appearance, and the colours mainly brown tones of great purity; there is a conspicuous crest, and distinctly coloured waxy-like tips to the inner wing feathers, and sometimes tail feathers. These birds are generally associated with wooded districts and live on insects and soft fruits.

Waxwings are very irregular in their breeding distribution and in their winter migrations. They are winter visitors to Britain and some years they are very common, particularly in northern districts, but in other years they are scarcely to be found.

Scientific Names. The common waxwing is *Bombus garrulus*, the cedar waxwing is *B. cedrorum*.

WEASEL, we' z'l. A small mammal, about 10-12 in. long, including the tail, related to the stoat (which see) and from which it can be distinguished by the lack of a black tip to its tail. Its general colour is reddish-brown above and whitish below. Like the stoat the weasel turns white in



WEASEL
Photo: Photopress

winter, but not so readily in the warmer temperate regions. It rarely turns white in Britain.

Weasels are found in the northern regions of the Old and New Worlds.

Scientific Name. Weasels belong to the family *Mustelidae*.

WEATHER. See CLIMATE; METEOROLOGY.

WEATHERING. The result of mechanical and physical changes brought about in rocks by the action of an outside force. The chief agents are frost, moisture, carbon dioxide, heat and cold, wind, plants, marine

boring and land burrowing animals. Frost widens crevices and chips rocks. Carbon dioxide and sulphuric acid and hydrochloric acid, etc., of town air attack various ingredients. Alternate heat and cold expand and contract the various mineral constituents, thus lessening their cohesion. Wind carries away fine debris and polishes rocks. Plants (lichens and mosses, etc.) help to disintegrate rocks, and trees, by the expansion of their roots, widen crevices. Marine animals (pholas, etc.) bore holes into submerged cliffs. Foxes, rabbits, moles, and worms help to break up subsoil. See GEOLOGY.

WEAVER BIRD. The common name of a family of small birds; it is derived from the



WEAVER BIRDS' NESTS
Photo: Cherry Kearton

elaborate interweaving manner in which the nests are made. The nests are entered from below; often more than 100 are found in a single tree. The weaver bird is native to Africa, Australia, and the warm parts of Asia.

Scientific Name. The weaver bird belongs to the family *Ploceidae*.

WEAVING. The art of making cloth by interlacing threads. To make cloth, the weaver passes one set of threads, known as the *weft*, alternately under and over another set of threads, known as the *warp*. To do this, he has to raise certain threads of the warp and lower others, in order to make room for the passage of his shuttle, carrying the weft to and fro across the web. The remaining operation is simply the driving of the weft threads firmly against the warp, so as to form a web of cloth of the required texture. In working into his cloth designs of one sort or another, the weaver naturally changes somewhat the order in which the threads are interlaced.

There are three fundamental weaves, known as *plain*, *twill*, and *satín*, respectively.

By variations of these weaves, fabrics of many kinds are produced.

Hand Weaving. The loom in its simplest form is a frame to hold the warp threads regular and parallel, and enable the wefts to move them freely, without the necessity of passing the shuttle over and under the alternate warp threads. This is effected by



HAND LOOM

means of healds consisting of two or more frames from which hang cords attached by a loop to each thread in the warp. As alternate threads are attached to each heald, it follows that, when one heald is raised, every second thread in the warp is lifted also. The healds are raised by an apparatus responding to the pressure of the weaver's foot on a pedal.

The Bayeux tapestries of the eleventh century and the Gobelin tapestries of the seventeenth are examples of the art of hand weaving in its most perfect form.

Jacquard Loom. Joseph Marie Jacquard, a Lyons weaver, introduced an important improvement in 1801, by which complicated designs could be woven as easily as simple ones. He contrived an arrangement of numerous hooks, by which threads could be lifted in any order and the figures wrought neatly into the web.

Power Loom. The power loom, invented by Edmund Cartwright in 1784, has since undergone many modifications. It is operated now by steam or by electricity, but the principle is that of the hand loom.

WEBB, SIDNEY, BARON PASSFIELD (born 1859). London born, he studied at the Birkbeck Institute and the City of London College. From 1878 to 1891 he was a civil

servant. His interests are sociological, and his study of economics and working-class organizations has made him an expert in these subjects. He married Beatrice Potter, also an economist, and she has collaborated in his books. They had much to do with the founding of the *New Statesman*. His many years of able work for the Labour movement won him the Presidency of the Board of Trade in the Socialist Ministry of 1924, and in 1929 he was Colonial Secretary.

WEBER, vay' ber, KARL MARIA FRIEDRICH ERNEST VON (1786-1826). A German composer, credited with the foundation of the romantic school of opera of which Wagner was the greatest leader.

Der Freischütz (The Free Shooter), *Eury-anthe*, and *Oberon*—the latter produced at Covent Garden in 1826—were the most successful of his operas. Other compositions which added to his fame include the popular *Invitation to the Dance*, *Jubilee Mass*, *Polonaise*, and *Konzertstück* (for piano and orchestra).

WEBSTER, JOHN (1580?-1625?). Webster wrote several plays in collaboration with contemporary dramatists like Dekker, Marston, and Chettle, but his greatest and best-known plays are of his own composition. These plays are *The White Devil* (first published in 1612), *Appius and Virginia* (published in 1654), and the *Duchess of Malfi* (published in 1623).

Webster's best work is second only to Shakespeare's in tragic force and intensity.



JACQUARD LOOM

Photo: Visual Education Service

Charles Lamb was the first to recognize and appreciate Webster's tragic genius.

WEDDELL SEA. A great bight in the Antarctic continent opening to the South Atlantic. It has an area of about 1,000,000 sq. miles, and most of it is filled with dangerous pack-ice for the greater part of the year.

Thus it is inadequately explored. It was discovered by James Weddell in 1823 and named by him King George IV Sea. Later explorations were by Bruce, Filchner and Shackleton.

WEDGE. A double inclined plane in which the force acts in a direction parallel to the base of the plane. The effort is applied usually by a blow with a heavy body, as when an axe and wedge are used to split a



THE WEDGE

log. The wedge has the same mechanical advantage as the inclined plane, except that the effect of friction is greater in the case of the wedge.

WEDGWOOD WARE. The name given to the pottery produced by Josiah Wedgwood. In 1762 he put his first new type on the market; it was cream- or straw-coloured and known as *Queen's Ware*. Possibly his finest pottery was *Jasper Ware*. In appearance it is a fine white terra cotta. Among the objects made of this ware are medallions, cameos, flowerpots, vases, etc. White cameo reliefs on a blue ground were used commonly for decoration.

Wedgwood was born at Burslem in Staffordshire in 1730, and began his business in the same town in 1759. He died in 1795.

WEDNESDAY. Name of the fourth day of the week, the day sacred to Woden, or Odin, the chief god of Norse mythology. The French call the day *mercredi*, from Mercury, the Roman god who is usually identified with Odin. See **WEEK**.

WEED. There is no dividing line between weeds and useful plants, except that of relation. Weeds are those plants which hinder the growth of other plants or have no economic value. Because grass grows in almost every cultivated field and is a hindrance to the crop, it is looked upon there as a weed, but it constitutes the wealth-producing crop of the hayfield and the pasture.

WEEK. An artificial period of time, including seven days, possibly based on the four phases of the moon. The ancient Chinese, Egyptians, Persians, and Babylonians are among the nations known to have had it as a division of time. Among the ancient Hebrews, the week was associated

with the belief in the creation of the world in six days, the seventh day, or Sabbath, being a day of rest and worship. Among the later Romans, the week was also connected with the sun, moon, and five planets. Each day was sacred to a Roman deity, who was associated with a planet, and the days were known, therefore, as Sun's-day, Moon's-day, Mars'-day, etc.

The English names of the days are translations or corruptions of the Roman, usually through the Scandinavian. Thus Sunday and Monday are easily traceable; Tuesday is *Tiu's-day*, from *Tiu*, or *Tyr*, the Norse god of war, corresponding to the Mars of the Romans, seen in the French word *mardi*, for Tuesday. Wednesday is *Woden's-day*, Woden (or Odin) being the Norse equivalent of Mercury, seen in the French *mercredi*, Wednesday. Thursday is palpably *Thor's-day*, with Jupiter as the corresponding Roman god, and is *jeudi* in French, or *Jove's-day*. Friday (French *vendredi*) is *Freyja's-day*, and Freyja corresponds with the Roman Venus. Saturday (French *samedi*) is easily identified as *Saturn's-day*. See also separate articles on the days of the week.

WEEVIL, we'e'l The name of a large number of small beetles, whose chief characteristic is a long snout, which sometimes exceeds the length of the body. This snout is used for burrowing in the plant material in which weevils live. The larvae, or grubs, are small and legless and white or yellowish in colour.

There are many thousands of species of weevils in the world, and in the great majority, both grubs and adults are destructive to plants. They are among the world's worst pests as they cause a tremendous amount of damage. For example, the grain weevil often destroys large stores of wheat, and the cotton boll weevil crops of cotton in America. Some weevils destroy roots, others stems or fruits.

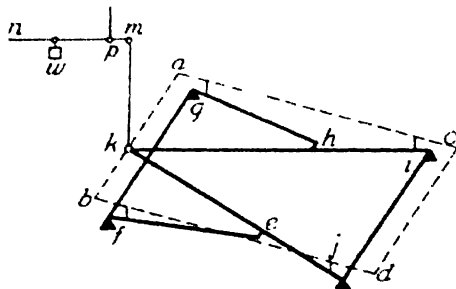
WEFT, OR WOOF. See **WEAVING**.

WEIGHING SCALE. A mechanical device used for determining the weight of any substance. There are many forms of these machines, but they are all based on the principle that certain weights balance each other, or that one will outweigh the other.

Two pieces of iron weighing exactly 1 lb. each, if suspended by two strings attached to each end of a balanced and pivoted rod, will not disturb the balance of that rod. If the weights are not equal, the heavier will pull its end of the rod down and raise the lighter weight. If the rod is not exactly balanced, but pivoted at a point nearer one end than the other, it would require a greater weight suspended from the shorter end to raise the pound suspended at the

longer distance from the pivot. Therein lies the principle of the lever, on which most scales are operated.

WEIGHT. A measure of the pull of gravity on any body (see GRAVITATION). To say that an object weighs 5 lb. is to say that the earth attracts it to that extent. A body at the centre of the earth would lack weight, because of equal attraction in all directions.



PRINCIPLE OF THE WEIGHING SCALE

A load is placed on the platform *abcd*. This load is conveyed to the system of levers by the standards *f, g, i, j*, and depresses them so that they exert a pull downward on the rod *km* and the short arm of the lever, *mp*. This pull is balanced by sliding the weight along the lever or scale beam *mn*, which is so graduated into pounds and fractions that the weight of the article on the platform can be read at a glance.

The weight of a body above the surface of the earth diminishes as it recedes from the earth's centre, at a rate proportional to the square of the distance. Accordingly, a mass of iron which weighs 1000 lb. at the equator will gain about 5 lb. at the poles.

WEIGHTS, ATOMIC. See ATOMIC WEIGHTS.

WEIGHTS, MOLECULAR. See MOLECULE.

WEIGHTS AND MEASURES. The general terms used to describe the standards employed in measuring weights, quantities, and volumes. Most of the units, as originally chosen, are arbitrary. To day, for scientific purposes a uniform system, the metric, has been very widely adopted.

WEI-HAI-WEI, *way hi way*. An area, with harbour, of 285 sq. miles on the north-east of the Shantung Peninsula in China. It was leased to Great Britain as a naval station in 1898, but restored to China in 1930.

WELDING. The art or process of joining two or more pieces of metal into one solid mass. This may be accomplished either by what is known as *smith welding*, or by one of the more modern processes, including the oxy-acetylene process, electric welding, and thermit welding, the last-named being more especially applicable to large and heavy work.

In smith welding, the pieces of metal to be joined are each heated to a plastic state, and they are then hammered or pressed together while hot, until they form one solid combined piece. The flame produced when a suitably proportioned mixture of oxygen and acetylene burns is so intensely hot that it will quickly melt any metal, even platinum. Consequently the oxy-acetylene process which involves the use of a blowpipe produces superior results. A crude form of the blowpipe has been used in metal working from times of great antiquity, it being recorded of the Egyptians and Romans. Its application to welding was not, however, general until the beginning of the twentieth century.

The acetylene flame used is raised to a high temperature, say 3500° F., by oxygen conveyed to a burner or torch with a suitable combining nozzle.

The adoption of electricity for the fusion of metals is of comparatively recent date. In this process electrical energy is trans-



ELECTRIC ARC WELDER AT WORK

Photo Fox

formed into thermal energy, or into heat, in the form of an electric arc. The metals are melted by the heat liberated at the arc terminals, and are in the arc stream.

When the arc is formed between the metal to be welded and the metal to be added, the latter being usually in the form of a wire or rod, it is termed *metallic-arc welding*. When the arc is formed between the metal to be

welded and a carbon or graphite rod, it is termed *carbon-arc welding*.

The thermit process, in the few years since its original discovery, has come into widespread use, particularly in railway repair shops. This process consists essentially of pouring molten thermit steel into a mould enclosing the parts to be welded. Thermit steel is a mixture of finely divided aluminium and iron oxide, placed in a crucible and ignited, and thus converted into a molten state. The process is based on a chemical reaction between the aluminium and iron oxide. Such a mixture can be ignited when brought to a high temperature in one spot, and the reaction, when so started, will continue throughout the rest of the mass; the result is that the aluminium combines with the oxygen of the iron oxide to form aluminium oxide (or slag) in a highly superheated molten state, while the iron is set free and is produced as liquid steel, also highly superheated. If steel at this high temperature is poured around and between two iron or steel sections, which have been previously heated to red heat, they will become dissolved and will amalgamate with the thermit steel, so that finally the entire mass will cool down to form a single homogeneous section—that is, a perfect weld.

WELL BORING. The drilling in the earth of holes of small diameter and of varying depth, to tap reservoirs of water, oil, or gas, or to discover deposits of iron and other minerals. Most deep wells are bored with a heavy, chisel-shaped bar having a cutting edge of steel, which descends vertically, crushing the rock by a succession of heavy blows. For penetrating denser rock, another sort of tool, the diamond drill, is used. The method usually adopted is to erect a derrick where the well is to be bored. A pulley in the tower of the derrick operates the crushing bar or drill by steam power. To facilitate the removal of debris, water is turned on the cutting to reduce the powdered rock to mud. The sides of the bore are lined with iron or steel casing to exclude surface water and prevent the rock sides from collapsing.

The newest method employed in drilling for oil, called the "percussion method," employs a string of long, narrow tools which may reach 60 ft. in length and weigh as much as 2000 lb. Depths of over 5000 ft. have been attained. See ARTESIAN WELL; PETROLEUM.

WELLESLEY, RICHARD COLLEY WELLESLEY, MARQUESS (1760–1842). The eldest son of the 1st Earl of Mornington, he was in 1797 created Baron Mornington and appointed Governor-General of India. He adopted a vigorous forward policy. Mysore

was conquered, the Sultan, Tipu Sahib, being killed in the fighting. The Mahratta confederacy was defeated by his brother, Colonel Wellesley (see WELLINGTON, DUKE OF). Mornington, now Marquess Wellesley, was bitterly attacked on his return to England in 1805, but it was subsequently recognized that he had greatly strengthened Britain in India. He was Lord Lieutenant of Ireland from 1821 to 1828 and from 1833 to 1834.

WELLINGBOROUGH. A Municipal Borough and market town of Northamptonshire with an area of 4265 acres and a population of 21,221 in 1931. It is pleasantly situated on the north bank of the River Nene, a peculiarity of the older part of the town being that many of the buildings, including the tower of the parish church, are built of ironstone. The town is of great antiquity, and, in Saxon times, was the principal settlement in the Hundred of Hamfordshoe. In the Domesday Book it is described as a town of 700 families closely associated with the Abbey of Crowland. Mineral springs were discovered in 1600, and, as a result of the royal patronage of Charles I., attained considerable popularity. To-day the waters are utilized for brewing. Owing to a disastrous fire which took place in 1738 little of real antiquity has survived, although a few ancient houses in Gold Street and Ship Street are carefully preserved.

Before the introduction of machinery Wellingborough won great prosperity from trade in hand-made lace, but after 1800 the leather trade developed. To-day Wellingborough is one of the principal centres of the boot and shoe industry, with its attendant trades of tanning and leather dressing. Iron ore has been quarried in the neighbourhood for many centuries. In addition, there are a number of minor industries including the manufacture of clothing, hats and cardboard boxes. Flour mills, printing works and breweries are also represented; brushes, metal window frames and scientific instruments are other products of importance. As a market town and shipping centre Wellingborough serves a large area of prosperous agricultural country. The parish church is a good example of Gothic architecture, mainly in the Perpendicular style, with a Decorated tower and traces of Norman workmanship in the south porch.

WELLINGTON. Capital of New Zealand. (which see).

WELLINGTON, ARTHUR WELLESLEY, 1st DUKE OF (1769–1852). Arthur Wellesley, or Wesley, the fourth son of Garrett Wellesley, Earl of Mornington, was born in Ireland, either in Dublin or at Dungan Castle, Meath.

He was educated at Eton and at a military college in France.

In 1787 he entered the army as an ensign, was made an aide-de-camp at Dublin Castle, and commanded enough influence to become a colonel in 1796. His first active military service was in the campaign in Flanders in 1794 and 1795, where he distinguished himself. In 1796 his regiment was sent to India. In 1799 he played a conspicuous part in the conquest of Mysore. Before he was 35, Wellesley attained the rank of major-general, and in 1803 was placed in command of the British forces in the Mahratta War. His success was very largely due to his admirably planned transport service. He won a dashing victory over an unexpectedly numerous enemy force at Assaye and a well-planned battle, with small loss, at Argauum.

Shortly after his return to England, in 1805, he was elected to Parliament, and in 1807 was appointed Secretary of State for



DUKE OF WELLINGTON
Photo Brown Bros

Ireland; in this year he served in the expedition sent to capture Copenhagen. In 1808 he was promoted to the rank of lieutenant-general, and was given command of a division of the forces operating against the French in the Peninsula (Spain and Portugal). There, three weeks after landing, he defeated the

French in the Battle of Vimiera, and the campaign closed with the Convention of Cintra, the French agreeing to evacuate Portugal.

In 1809 he was given chief command of the British forces in the Peninsular War. With what aid the governments of Spain and Portugal could give he gradually drove the French forces from the Peninsula, winning notable victories in the battles of Talavera, Busaco, Fuentes de Onoro, Salamanca, and Vittoria, and capturing Ciudad Rodrigo and Badajoz by storm. In the Battle of Toulouse, in 1814, he opened the way for the British troops into the heart of France. For this masterful campaign and its brilliant successes, Wellesley received many Spanish and Portuguese titles, official thanks, and large gifts from Parliament, and was created, successively, Viscount and Marquess and Duke of Wellington, and appointed Field Marshal. See PENINSULAR WAR.

Like the great antagonist that he had yet to meet, Wellington had a remarkable

memory for detail. Much of his success in the Peninsular was due to his magnificent organization of commissariat and transport. He was himself indefatigable, content with few hours of sleep and picnic meals. Before battle he sometimes took great risks in making a personal reconnaissance of the enemy's position and in action his dapper, inconspicuously clad little figure was usually to be seen wherever the situation was most critical, a post on his Staff being both strenuous and dangerous. He was hard on himself and on his command, being inclined to take good service for granted and to salute imperfect success with blistering rebuke. He could be genial and he could praise, but more often he was grim and somewhat ungracious. From his troops he never won such devotion as was felt for Marlborough or for Nelson, but he commanded an unbounded respect—"the sight of his long nose among us was worth ten thousand men any day." His comments on the British fighting man were brutally frank and it is true that many recruits came from the criminal classes. Nevertheless, in spite of the three appalling days of drink, rapine and massacre when Badajoz fell, it appears that he was at least doing an injustice to the admirable training carried out in England under various leaders in his repeated condemnation of "those to whose conduct, discipline and gallantry their country is so much indebted" (Final Army Order to Peninsular Army, 1814.)

In July, 1814, he was appointed ambassador to France, and the following year represented Great Britain at the Congress of Vienna. When Napoleon returned and made history during the notable "hundred days," Wellington took command of the allied forces in the Netherlands, and in the Battle of Waterloo rode at the head of the army which shattered the last vestiges of Napoleon's power.

On 16th June Napoleon, who had placed himself between the two allied armies, defeated the Prussians at Ligny, while Ney was held back by the Anglo-Dutch at Quatre Bras. On the next day Napoleon followed up the retreating Wellington, sending Marshal Grouchy to keep the Prussians on the run. Grouchy misjudged the situation and the Prussians swung northwards to regain touch with the British, urged on by Blücher, whose exhortations won him the nickname of "Old Marshal Forwards." Wellington selected at Waterloo a defensive position of his favourite pattern, stationing the majority of his troops just over the crest of the hill, so that they were protected from cannonading: on an infantry attack, they held the crest in line formation, pouring a withering

fire on the French, who attacked in column: to receive cavalry they formed into squares, with the guns inside. The farmhouses of Hougomont and La Haye Sainte were strongly held. The first attack was at 11.30, followed by a heavy cannonade, but as the main attack advanced at 1.0 the first Prussian corps under von Bülow appeared on the British left. A fierce battle followed, the French attacks being repulsed by the foot soldiers or broken by the British cavalry. The Prussians first came into action at about 4.30. At 6.0 Ney took La Haye Sainte; Hougomont had already been seized from the Dutch and retaken by the Guards. Shortly before 8.0 the British lines were attacked by the famous Imperial Guard, Ney, "the bravest of the brave," leading them on foot, sword in hand. The British lines held firm and, as the Guard began to recoil, the Duke, who had personally directed the most critical actions of the day, galloped Copenhagen, his favourite chestnut, to a conspicuous rise and signalled with his cocked hat. The entire British line broke into a cheer and charged the retreating French. Except for the battalions of the Guard, the retreat became a rout and the Prussians took over the pursuit as the darkness closed in.

As a reward for Waterloo, Wellington received a grant of £200,000 from Parliament, having already received £500,000 for the Peninsular campaigns. He was placed in command of the army occupying France from 1815 to 1818, and became

one of the most influential men in Europe. The moderation shown to France was largely due to his influence and he was responsible for the international financial settlements.

After returning to England, he occupied various government and diplomatic positions of importance. In 1827 he became Premier. Convinced that the Irish situation demanded Catholic Emancipation, he persuaded the Tories to accept it and wore down the opposition of George IV. His government became highly unpopular through his opposition to Parliamentary Reform, and in 1830 he was forced to resign. In 1834, after declining the premiership, and in 1841 Wellington again occupied a seat in the Cabinet, and resumed command of the army from 1841 to 1846, when he retired. During the last years of his political career, his great services being remembered when the political excitement had died, he regained his popularity.

WELLS. A Municipal Borough and cathedral city of Somerset with an area of 719 acres and a population of 4833 in 1931, situated at the foot of the Mendip Hills, 20 miles from Bath and a similar distance from Bristol. Since the Middle Ages the life of the town has centred round the cathedral which was founded as a secular church by King Ina. In the present building many styles of architecture are represented—the font is Early Norman, the nave and transepts Late Norman, the famous west front Early English, the tower and the choir represent



WELLS CATHEDRAL FROM MILTON HILL

Photo: Frith

the Decorated period of Gothic architecture and the west tower and cloisters the Perpendicular. The statuary in the west front is unique and was placed there in the thirteenth century when the façade was moulded under the direction of Bishop Joceline. The bishop's palace with gate house and drawbridge retains the castellations and much of the original fabric of the thirteenth-century building. Bishop Bubwith's almshouses are most unusual in design and contain a number of separate cells with a communal hall and chapel. Finally, in the courtyard of the "Crown" Inn there is some fine timber work of unknown date but considerable antiquity.

WELLS, HERBERT GEORGE (born 1866) An English author whose vigorous writings are a notable addition to literature. He was born at Bromley, Kent, of middle-class parents, and was educated locally and later at the Royal College of Science at South Kensington. He graduated with first-class honours in 1888.

In 1895 Wells produced *The Time Machine*. This was followed by several romantic

novels, and in 1898 by another scientific romance, *The War of the Worlds*, *The Food of the Gods*, and *In the Days of the Comet* were other tales. His interest in socialistic ideals is shown in *A Modern Utopia*, *New Worlds for Old*, and *First and Last Things*. *Mr. Brilling Sees It Through* (1916) gave a picture of the home front during the World War, and *What is*



H. G. WELLS
Photo: U. & U.

Coming? (1916) and *In the Fourth Year* (1918) are described by their dates and titles. In 1921 appeared *The Outline of History*; in this and *The Science of Life* and *The Work, Wealth and Happiness of Mankind*, Wells attempted to set forth the whole history of man in terms of history, biology, and economics. *Experiment in Autobiography* was published in 1934.

WELSBACH, vels' bahk, KARL AUER, BARON VON (1858-1929). He was the inventor of the Welsbach gas burner, which revolutionized methods of lighting by gas. He was born and educated in Vienna, Austria, and also attended the University of

Heidelberg, where he studied under Bunsen, the inventor of the Bunsen burner. The Welsbach burner is made with a cone-shaped cotton-gauze mantle of oxides of thorium and cerium. When first lighted, the cotton burns away, and there is left a skeleton of the oxides. This becomes incandescent, and throws out a strong, clear light. Welsbach also invented the osmium incandescent electric lamp in 1898, and in 1907 discovered a new element known as lutecium. He was the author of several scientific works in the German language.



VON WELSBACH
Photo: Brown Bros.

WELSH CORGI. A Welsh dog which is used as a guard, and to drive cattle. He is a quaint-looking little fellow with short legs, comparatively long body, erect ears and fox-like head.

There are two types - the Pembroke (distinguished from the Cardigan mainly by his short tail), weighing 18-30 lb. and standing 14 in. at the shoulder, the legs are as straight as possible, coat of medium length and dense, the colour red or red and white, while the Cardigan with his long fox-like tail, which must not be curled over the back, and slightly bowed front legs, stands about 12 in. at the shoulder, weighs 18-26 lb. and his short or medium coat of hard texture may be of any colour, except pure white.

WELSHPOOL. See MONTGOMERYSHIRE.

WELSH TERRIER. A sporting dog which has been common in Wales for a great many years. Alert and very active, he is less noisy than the majority of terriers. His size is indicated by a height of 15 in. at the shoulder and a weight of about 20 lb. The coat, wiry, hard and abundant, should be black-and-tan or black-grizzle-and-tan in colour.

WEN. A cyst resulting from the retention of secretion in a sebaceous gland. One or more rounded or oval elevations, varying from the size of a pea to that of a large apple, may slowly appear on the scalp, face, or shoulder. Wens are soft and painless, and contain a yellowish-white matter, which sometimes may be squeezed out.

WENCESLAUS, wen's ses las. The name of four Bohemian rulers. Wenceslaus II, who ruled from 1278 to 1305, gained control of

Poland as well as of Bohemia and tried to conquer Hungary. His empire collapsed when his son and successor, Wenceslaus III, died in 1306. Wenceslaus IV (1361-1419), son of the Emperor Charles IV, was crowned King of Bohemia in 1363 and King of the Romans in 1376. He lived in Bohemia outside the German kingdom. Angered by this and by his drunkenness, the four German Electors deposed him in favour of Rupert, Elector Palatine, in 1400. Wenceslaus continued ruler of Bohemia.

WENTWORTH, THOMAS, EARL OF STRATFORD. See STRATFORD, THOMAS WENTWORTH, FIRST EARL OF.

WESLEY. The name of two brothers who founded the religious sect which developed into the Methodist Church. See METHODISTS.

John Wesley (1703-1791) was born at Epworth, Lincolnshire, 17th June, 1703, the fifteenth child of Samuel Wesley, rector of Epworth. Educated at Charterhouse and Christ Church, Oxford, in 1725 he was ordained to the ministry. He returned to Oxford in 1729 and became associated with the "Holy Club" which had been founded by his brother. On the death of their father in 1735 both brothers travelled to America and undertook missionary work in Georgia.

His visit lasted less than three years. On his return he became interested in the Moravian faith, which was the foundation of his evangelical work in England from 1738 onwards. He founded many evangelical missions which came to be known as United Societies. The first building erected for their use was in the Horse Fair, in Bristol. Lay preachers, or "class leaders," were appointed to have charge of little groups of converts. It was not an uncommon experience for Wesley to address from 10,000 to 30,000 people in the open. In 1747 he first visited Ireland, and in 1751 he visited Scotland. He held the first conference with his helpers in 1744, but not until 1784 was the "conference" constituted the governing body of a new Church, separate from the Church of England. Before his death, Wesley's actual followers numbered 120,000.

Charles Wesley (1707-1788), brother of John Wesley and the early song-writer of Methodism. For many years he assisted his brother as an itinerant preacher and was one of the founders of the new sect.

He was less extreme in his views than was his brother John, and viewed with disfavour the desire of the Methodists to



JOHN WESLEY (left) AND CHARLES WESLEY
Photos: Brown Bros

WESSEX. The Kingdom of the West Saxons embraced the south-west of Britain. The Saxons were Teuton invaders, who came from the neighbourhood of Holstein, crossing the North Sea and establishing themselves in Hampshire under the leadership of Cerdic in the year 519. In the following year, at Mount Badon, near Bath, the Britons under Arthur temporarily checked the pressure of the invaders westwards. But expansion to the east and the north continued under Ceawlin and Cynric. The latter by his victory at Deorham (Somerset) in 577 drove a wedge between the Britons of Wales and those of the south-west peninsula.

A great struggle for supremacy followed in which the West Saxons contended for supremacy with the other invading peoples, especially the Northumbrians and the Mercians (which see). During the eighth century, the strength of Wessex was steadily growing at the expense of Mercia. In 802 Egbert, who had found refuge with Charles the Great from the violence of Offa of Mercia, became King of Wessex, and in 825 he finally crushed the Mercian power at Ellendun.

The success of Wessex was due to many contributing factors. The territory included London, the commercial capital, and Canterbury, the ecclesiastical capital, as well as Winchester, the royal city. There were no serious geographical obstacles to communications. The line of the kings produced several strong and vigorous personalities. The accession of Egbert marks a definite advance in the art of government and in intellectual achievement. His reign was a period of consolidation and a sentiment of nationhood began to arise in England. He was acknowledged as suzerain by all the Anglo-Saxon settlements south of the Tweed, and it is this supremacy which enabled his successors to resist the Danes so strongly.

By the Treaty of Wedmore (878) which Alfred made with Guthrum, the Danish leader, a division of the territory was effected and the authority of the West Saxon Kings was confined to the region south of a line which followed Watling Street from London to Chester. The Danes withdrew to the north of this line.

The successors of Egbert on the throne of Wessex were Alfred (871-901), Edward the Elder (901-925), Athelstan (925-940), Edmund (940-947), Edred (947-955), Edwy (955-957), Edgar the Peaceful (957-975), Edward the Martyr (975-979) and Ethelred the Unready (979-1016). Edgar and his successors were Kings, not of Wessex, but of England, for the North had been gradually conquered. Then followed the absorption of England into the Danish Empire under Cnut

(1016-35). Edward the Confessor (1042-1066) was a son of Ethelred, whose great-great-grand-daughter, Edith Matilda, later married Henry I. The Royal House thus descends from Cerdic.

WEST BROMWICH, *brum' itch*. Six miles from Birmingham is the South Staffordshire County Borough and market town of West Bromwich, with a population of 81,281. It is served by the G.W.R. and L.M.S.R., and is 115 miles from London. It is a busy manufacturing town, yet has a history dating back to Anglo-Saxon times. It was a rural district nearly up to the nineteenth century, when coal was first mined within the borough. It was made a county borough in 1890. Its chief industries are connected with the production of machinery, tools and metal work, brick-making, coal mining, etc. The town is within easy reach of many of the beauty spots of Warwickshire and Worcestershire.

WESTERN AUSTRALIA. The largest and least-populated State of the Australian Commonwealth, it occupies the western third of the continent. In this vast territory, with an area of 975,020 sq. miles, there are 450,243 (1936) inhabitants. There are large sections in the interior quite unpopulated, the majority of the people being concentrated in the south-west corner.

Physical Features. The coast line, which has a total extent of about 5200 miles, has very few natural harbours. The greater part of the State is a plateau varying in altitude from 700 ft. to 1000 ft., and the greater portion of it, with the exception of small areas, is practically sterile, being a part of the great desert which occupies the middle of the Australian continent. Round the coast the plateau falls to lower levels.

Natural Resources. Western Australia has a hot and dry climate. Regular and abundant rainfall occurs only in the south-west where the fall averages 30 in. a year; in other regions, barely 10 in. a year are registered. In the south-west wheat is the chief crop; barley, hay, oats, and potatoes are also grown, and there are some vineyards. Large tracts of good grazing land are also found here, and support increasing numbers of cattle and sheep. Dairying, poultry-raising, and bee-farming are among the occupations.

Extensive forests constitute one of the principal sources of wealth. There are many varieties of eucalyptus, or gum trees. Of still greater importance is the mineral wealth of the State, especially gold. The chief gold-fields are in the Coolgardie and Kalgoorlie districts. Other minerals mined are copper, tin, and coal, besides some silver. Much pearl shell comes from Western Australia.



GENERAL VIEW OF PERTH, WESTERN AUSTRALIA

Photo: Australian Trade Publicity

The government operates about 3700 miles of railway.

Government and History. Western Australia is governed by a Cabinet of ministers responsible to a legislative assembly and a legislative council. The former consists of fifty members elected for three years, and the latter of thirty members elected for six years. Both women and men have the suffrage.

This Western part of Australia was first visited by Europeans in the sixteenth century; the first English settlement was made in 1826. Colonization on a systematic plan began in 1829, when Captain Stirling founded the Swan River settlement, now the State of Western Australia, and the towns of Perth and Fremantle. Western Australia entered the Australian Commonwealth in 1901 as one of the six original States. In 1934 the Legislative Assembly passed a bill to petition the Imperial Parliament to grant the

State secession from the Commonwealth. A committee of both houses decided that the petition could not be received.

Perth. The capital lies on the Swan River, a few miles north-east of Fremantle, its port on the Indian Ocean. It grew rapidly during the last decade of the nineteenth century as a result of sensational gold finds in the State. The city is linked with Brisbane on the eastern coast by a transcontinental railway, opened in 1917. It is the seat of the State university. Population, 1933, was 182,216. Fremantle, the chief port of the State, has a population of 25,224 (1933).



NEWDEGATE ISLAND, NORNALUP INLET, WESTERN AUSTRALIA

Photo: Australian Trade Publicity

WESTERN SIBERIAN REGION. With an area of 450,000 sq. miles, this a division of the Asiatic territory of the U.S.S.R. It is chiefly a plain area lying around the upper reaches of the Rivers Ob and Irtysh; some is swamp but much is fertile if rather dry. The Trans-Siberian and other railways cross

the territory. There are valuable coal deposits in the south and some iron-ores. The population is estimated at nearly 9,000,000 including many Russian settlers. Novo-Sibirsk (population 278,000) is the capital.

WEST HAM. A suburb of east London, in Essex, with a population of 204,086. It is a town of recent rapid growth. Shipbuilding, brewing, and the manufacture of matches, soap, chemicals, and artificial manures represent its activities. The Rivers Thames and Lea form the boundaries of the county borough. There are extensive docks and rail, road, canal and river transport services.

WEST HARTLEPOOL (*1pool*) A port and manufacturing town on the north-east coast of Durham, with an estimated popu-



WEST HARTLEPOOL

The Town Hall

Photo: Taylor

lation of 71,550. Shipbuilding is the staple industry, with the allied industry of marine engineering also of great importance. In close proximity to one of England's richest coalfields and the Cleveland iron district, West Hartlepool is fortunately situated, and has iron and steel works. Timber is the chief import and coal the chief export. The town has a popular seaside resort, Seaton Carew.

Less than a century ago, the site on which West Hartlepool now stands consisted of sandbanks, mossy swamps, and agricultural fields. In 1845 the foundation stone of the harbour was laid, and the town developed rapidly, being made a county borough in 1902.

Among the important buildings should be mentioned the ancient church of Stranton (early fourteenth century).

WEST INDIES, in' diz. The first land sighted by Columbus, and thought by him to be a part of India. The West Indies constitute a group of islands between North and South America, separating the Caribbean

Sea and Gulf of Mexico from the Atlantic Ocean. Most are the summits of a submerged mountain chain, but the larger ones are relics of a former large land area. Their total area is about 100,000 sq. miles. The largest island, Cuba, is independent; Haiti and Santo Domingo are two independent governments on one island. The other islands are colonies, the most important of which are the following:—

British. Jamaica, Cayman, Trinidad, Barbados, Bahamas, Leeward Islands, Windward Islands, Turks.

Dutch. Curaçao

French. Guadeloupe, Martinique.

United States. Puerto Rico, Virgin Islands.

About half of the 9,500,000 people on the islands are of African ancestry, but white people rule everywhere, except in Haiti, and in Cuba and Puerto Rico the whites are largely in the majority. The principal products of the islands are sugar and fruit. Articles on the separate islands will be found elsewhere.

WESTINGHOUSE, GEORGE (1846-1914)

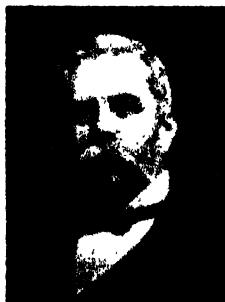
An American engineer, inventor and manufacturer, who invented the air brake now known by his name. This was patented in 1868 after Westinghouse had already done valuable research in methods of diverting trains from one track to the next. See BRAKE.

WESTLOTHIAN.

Formerly known as Linlithgowshire. West Lothian is a maritime county

on the southern shore of the Firth of Forth. It has an area of 120 sq. miles, a population of over 80,000 and returns one member to Parliament. It has two Royal burghs—Linlithgow and Queensferry—and the important seaport of Bo'ness. West Lothian has the distinction of appearing in the earliest Scottish historical records. The famous family of Dundas can trace a direct line of ancestors living, until recent years, continuously in the same place, from as far back as William the Lion, 1165.

In many parts of the county are to be found clear indications of past volcanic disturbances. Such signs are particularly noticeable at Dundas Hill in the parish of Dalmeny where there are many basaltic rocks. There is a good deal of woodland on the hills and about one-third of the county consists of old pasture land. In the early



GEORGE WESTINGHOUSE

Photo: Brown Bros.



LINLITHGOW PALACE, WEST LOTHIAN

Photo: Taylor

part of the eighteenth century the Earls of Stair and Hopetoun aided agriculture by the introduction of ploughs. Since then, to the present day, there has been profitable output of oats, barley, wheat, beans, ryegrass, and clover; and the grassland provides for the breeding of sheep, cattle and horses.

Also there is considerable mineral wealth, for coal is found throughout the county, also limestone and some ironstone. The sub-



ST. MICHAEL'S CHURCH, LINLITHGOW

The tracery shows French influence.

Photo: Taylor

soil consists of the best quality sandstone, with fireclay and brick clay, and special value attaches to the shale product. This is of exceptional quality, and the extraction of paraffin oil from the shale is an extensive industry with works at Winchburgh, etc. Other industries include iron and steel foundries, chemical works, paper mills, distilleries, and the manufacture of earthenware, bricks, and tiles. The output of oil shale is about 2,000,000 tons per annum. There is a railway to Queensferry for the Forth Bridge. There is one canal, almost disused.

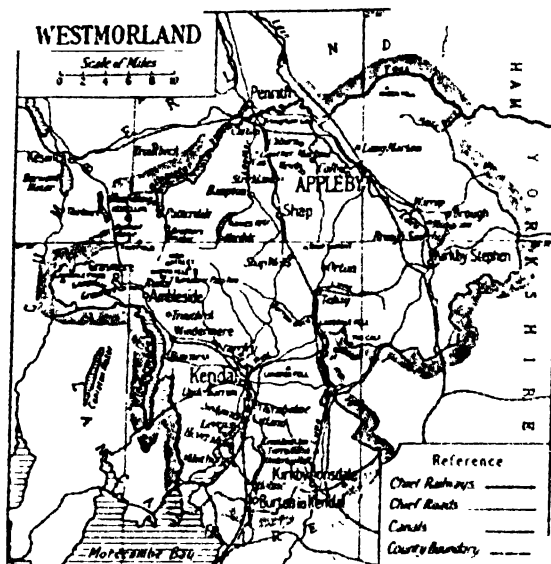
WESTMINSTER, STATUTES OF The Statutes of 1275 and of 1285, both of the reign of Edward I, review and codify the confusion of medieval law. They clear up confusions rather than introduce new principles; the most important novelty is the introduction of the law of entail. The Statute of 1931, passed in the reign of George V, fixes the Dominions entirely of the control of Great Britain, making the Crown the sole link of Empire.

WESTMINSTER ABBEY. An English national church and one of the most famous ecclesiastical buildings in the world. Its origin is derived from the monastery of St. Peter, believed to have been built by the Saxon King Sigeric (577-616). Tradition has it that Saint Peter himself dedicated the church. In 1050 Edward the Confessor began the erection of a new church of cruciform shape, which was consecrated in 1065. Henry III, in 1245, began the rebuilding of the eastern part of the church, which was completed by numerous additions and alterations later. In the sixteenth century, Henry VIII built the beautiful chapel which bears his name. Sir Christopher Wren designed the western towers, which were completed in 1740, after his death. The north front was rebuilt a hundred years later.

The total exterior length of the church is 511 ft., and the transepts, or arms of the Latin cross in the ground plan, are 203 ft. long. The nave, exclusive of the aisles, is 38 ft. wide, and its height is 102 ft.

All the English kings from the time of William the Conqueror (1066), except Edwards V and VIII, have been crowned there, and in the chapel of Edward the Confessor there is kept the old Coronation Chair dating from Edward I, with the ancient block declared to be the stone which the patriarch Jacob used as a pillow.

Henry VII, Elizabeth, Mary Queen of Scots, Charles II, William and Mary, James I, and other kings and queens are interred in the chapel of Henry VII, which is specially reserved for royalty; Warren Hastings, Fox, the elder and younger Pitt, Wilberforce, and numerous other statesmen lie elsewhere in the Abbey. In the south transept are the tombs of Chaucer, Spenser, Tennyson, Browning, and others of the great poets of England, while nearby lie Dickens, Butler, Johnson, Addison, and other famous men of letters. Britain's "Unknown Warrior" lies in the centre of the nave.



WESTMORLAND. A north-western county of England bounded on the north by Cumberland, on the south by Lancashire and Yorkshire, on the east by Yorkshire and Durham, and on the west by Lancashire and Cumberland, with an area of 504,917 acres, and a population in 1931 of 65,398.

Physical Features. Westmorland shares with its neighbouring county Cumberland the distinction of being one of the only two mountainous counties in England, and shares also with Cumberland the distinction of possessing within its border several of the most beautiful stretches of inland water in the country. The dominant physical feature is the line of the Pennine Chain which occupies the eastern quarter of the county, entering it from Cumberland a little to the south of Cross Fell, and passing southward into Yorkshire at Swarth Fell. This is predominantly an area of rough moorland where stone outcrops often give a rocky landscape, and where the hilltops are covered

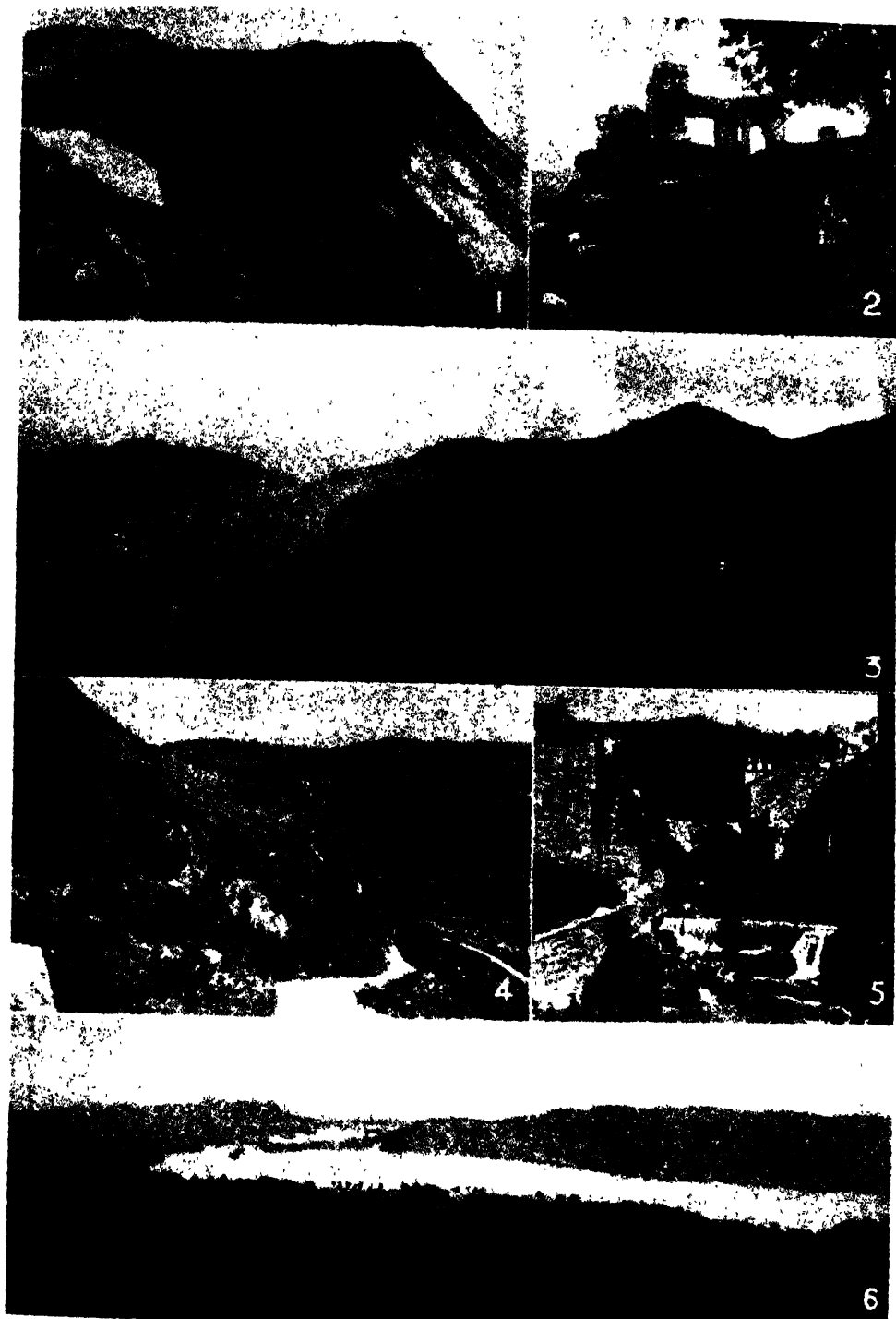
with thin heather and rank grass. Shallow bogs abound on the higher ground and only on the western slopes is there abundant pasture. The scenery is desolate and the high ground comparatively uninhabited, whilst mountain streams flow east and west from the watershed. These are numerous, but except after heavy storms carry little water. Some of the highest peaks from north to south are Milburn Forest 2478 ft., Blackstone Edge 2262 ft., Hilton Fell 2446 ft., and Wildboar Fell 2323 ft. The famous rocky and precipitous slopes of Bow Fell are just outside the county boundary.

The next most important feature, and one which has attained greater fame because its scenery is more picturesque, is the Cumbrian group of mountains which occupies the district to the west of a line drawn from Penrith to Kendal. In this area grass predominates to a far higher altitude than in the Pennines, but there are heather moors on the higher peaks and considerable outcrops of rock which often take the form of screes offering more or less precipitous slopes. The volcanic origin of the mountains is shown by the irregular pattern which they form, unlike the long watershed of the Pennines. Helvellyn 3113 ft., and Bow Fell 2960 ft., are both on the border of Cumberland. Yarnside 1937 ft., Harter Fell 2500 ft., Fairfield 2863 ft., and Langdale Pikes 2401 ft., are among the most notable hills in the central part of the range.

In the valleys between the volcanic mountains there are several considerable lakes, including within Westmorland the greater part of Ullswater and Windermere, the two largest lakes of north-west England. Hawes Water, Grasmere, Rydal Water and Brothers Water are entirely within the county. Among the finest of the screes are the Red Screes, overhanging the Kirkstone Pass.

The remainder of the county is more generally undulating, and much more fertile. The central part between the Pennines and the Cumbrians is occupied by the valley of the Eden, which rises in the south-east and flows in a general north-westerly direction through Appleby, forming for several miles the boundary with Cumberland. The southern quarter is watered by the River Kent which flows south-west through Kendal into Morecambe Bay.

History. The whole of the county fell within the Roman province of Britain as constituted by Agricola, and though not as



WESTMORLAND

1. Striding Edge, Helvellyn. 2. Kendal Castle. 3. View from Esk Hause. 4. Kirkstone Pass (1476 ft.). 5. The Old Mill, Ambleside. 6. Lake Windermere.

Photos: Frith; Davies

extensively colonized as that part of Cumberland which lay near the Roman Wall, seems to have been fully exploited by the Roman troops and later by a number of merchant settlers. From the decline of the Roman administration to the later Middle Ages was a period of almost continuous strife in spite of the mountainous nature of the country, which made fighting, except by guerilla tactics, difficult, and did not encourage extensive population. During the period of the Anglo-Saxon Heptarchy the county formed part of the Kingdom of Strathclyde, but appears to have sheltered numbers of the Romano-British population who fled to the mountainous districts of the west and north-west to escape from the attacks of the Saxon tribes. Even so, the Norsemen occupied it, as shown by considerable traces of their civilization at Kendal, Appleby and other places.

The greater part of Westmorland was not included in the first Conquest of Britain by the Normans. In the Domesday Survey the lowlands of South Westmorland are listed, but it appears that the northern parts were held by the Scots. An expedition of William Rufus established a nominal control and it was due to his influence that the present boundary of the county was fixed. In the twelfth and thirteenth centuries, when most of Cumberland was annexed to Scotland, Westmorland felt the full brunt of the Border warfare, and it was not until after the Union that any lasting peace was attained. In 1745 the Battle of Clifton Moor, which marked the defeat locally of the Young Pretender, was fought inside the county. The last two centuries have witnessed an increase in prosperity and a tendency to cultivate the land to a higher altitude than was previously considered practicable.

Antiquities. Prehistoric and Roman antiquities are equally numerous. The most important of the many stone circles attributed to the later Stone Age is the double circle at Gunnerheld. Hilltop camps are also numerous, both in the Pennines and the

Cumbrians, and there are several round barrows, one at Crosby Barrett being of exceptional size. A Roman road extends along the western slopes of the Pennines whilst numerous remains of the Roman occupation have recently been excavated at Ambleside. The most important relics of the early Saxon period are the worked monumental crosses, of which there are several in some of the rural churchyards.

The medieval period is represented by Norman work in certain of the churches, particularly that of Kirkby Lonsdale. The ruins of Shap Abbey, a house of the Pre-

monstratensians, are picturesque as well as important, and include the original abbey tower. The sites of nine castles are recorded but those at Hardela, Hartley, Hammerside and Pendragon have disappeared entirely. Of Green-castle, once a stronghold of the first importance, no masonry has survived. Kendal Castle retains only a little of its original shell,



KENDAL

The river, bridge, and church.

Photo: Taylor

but sufficient for a reconstruction of the ground plan to be possible. The remains of Appleby and Brough are by far the finest in the county and are of equal picturesque and archaeological interest.

Communications. From the Roman period, when a considerable network of roads was constructed, until the end of the eighteenth century, communications were extremely few and poor. It was at that period that the road from Penrith to the south was constructed and further roads followed quickly. The railway line from Lancaster to Carlisle which served Kendal and Shap was opened in 1859. To-day several other lines are operating including a branch of the Lancaster-Carlisle line from Kendal to Windermere, and another line which serves Kirkby Lonsdale and Sedburgh with a branch running eastward to Tebay, whilst yet another line follows roughly the valley of the Eden, with a connection to Hawes and central Yorkshire.

The rivers of the county are not navigable, but there is good and increasing communication by road. The many villages of the central and southern plain are served by

roads of good surface. In the mountainous districts of the Pennines and Cumbrians, however, roads are comparatively deficient. Only one crosses the Pennines in Westmorland, going east from Brough. In the Cumbrians a good road connects Kendal, Windermere, Ambleside and Keswick, whilst another from Windermere by way of the Kirkstone Pass serves Patterdale and Ullswater. Most of the other passes are difficult and many roads ascend the valleys but end before crossing the mountains.

Agriculture and Industries. Agriculture is the most important industry, and sheep rearing the most profitable branch of it, more than 400,000 sheep being recorded in the rich pastures of the lower fells. In the valley of the Eden and the southern plain large herds of cattle are raised and dairy-farming is on the increase. Horse breeding also is carried on profitably and a hardy breed of pony is raised on the fells.

Cereals and root crops are confined almost entirely to the valleys and are principally of local production. Large quantities of hay are gathered for winter stock feeding, but less than one half of the total area is productive, and within this considerably more than half is permanent pasture.

Manufacturing industries are almost confined to Kendal except for the local occupations connected with agriculture. Boot and shoe manufacture ranks first amongst Kendal's industries. Lead working has been carried on in the Cumbrian mountains from periods of great antiquity but is now on the decrease, whilst granite is quarried extensively on Shap Fell and there are several slate quarries in various parts of the county. The woollen industry is also well represented in Kendal.

Principal Towns. The county town is Kendal (which see). Ambleside and Appleby will also be found in their alphabetical positions. The only other towns with a population exceeding 1000 are Kirkby Lonsdale 1370, Shap 1227, and Windermere 5701. Each one of these shows a decrease in population in the 1931 census as compared with that of 1921. Grasmere, which had 1173 inhabitants in 1921, had fallen by 1931 to 988.

WESTMORLAND, Earls of. The title was created for Ralph Neville, Baron of Raby, who joined Henry IV on his landing

at Ravenspur in 1399. When taking over the wardenship of the North he dispersed a rebellion headed by the Percies and Archbishop Scrope by negotiating with the leaders; he afterwards had them arrested and delivered up to Henry. The sixth earl (d. 1601) took part in the unsuccessful rising in the North in favour of



WESTON-SUPER-MARE

Above: The Promenade. *Below:* A general view of the town.

Photos: Taylor

Mary Queen of Scots and later fled to the Netherlands, where he spent the rest of his days.

WESTON-SUPER-MARE. An urban district and seaside resort of Somersetshire with an area of 2412 acres and a population in 1931 of 28,555. It lies on the shore of the Bristol Channel, 12 miles in a direct line from Cardiff. It is a town of recent growth.

As Weston has increased from a small fishing village in the course of less than a hundred years, buildings of antiquarian interest are non-existent, with the exception

of the parish church which has some thirteenth-century glass in the east window, and the remains of a Runic cross in the churchyard. On the hill, immediately behind the town, Worlesbury Camp is a fortification of unique interest. This occupies an area of nearly 10 acres and is defended by a stone rampart now in fragments, and by two other walls divided by ditches. Within the confines of the inner wall nearly

ster is the capital city, with a population of 122,210 (1933).

WEST VIRGINIA. A southern State of the American Union with an area of 24,170 sq. miles and a population in 1930 of 1,729,205. The State has four regions: the Potomac Valley in the north-east, the Allegheny plateau, the Cumberland plateau, and the Ohio Valley. Spruce Knob, in Pendleton County, 4860 ft. in height, is the highest point in the State.

In spite of a rough surface and dense forests, considerable headway has been made in agriculture. About 60 per cent of the total land area is in farms. The fertile valley in the north-east and the Ohio Valley are the chief farming districts. Maize is grown in every county. Potatoes, oats, wheat, tobacco, and rye are other leading crops.

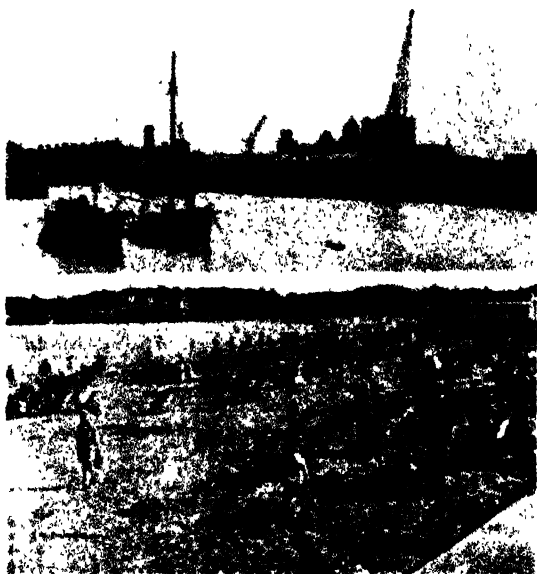
The grassy slopes of the mountains and hills furnish pasture land for livestock, and in the blue-grass regions of the south-eastern counties dairy-farming is important. Sheep are raised, and woollen mills are being introduced.

Minerals are of great importance. The coalfields are spread over two-thirds of the total area of the State and a fair quantity of petroleum is raised in several places. The iron and steel industry, glass manufacture and timber products, are the leading industrial activities.

WEXFORD. The capital of Co. Wexford, Irish Free State, and a port at the mouth of the River Slaney, with a population of 12,226. It is 87 miles from Dublin on the

G.S. railway. The town is very ancient, and was a Danish stronghold. Some of the old fortifications still remain. There is some fishing, brewing and distilling, and agricultural produce is exported. Its harbour is only deep enough for small steamers and fishing boats.

WEYMOUTH, way m'th. A Municipal Borough of Dorsetshire with an area of 1317 acres and a population of 21,982 in 1931. A greater part of modern Weymouth is strictly in Melcombe Regis which was formerly a separate borough with its own parliamentary representative. The town's popularity as a watering-place has arisen from its position on a narrow neck of land which juts out into Weymouth Bay and is continued to form the Isle of Portland. The surrounding country, consisting almost entirely of chalk downs, is rich in traces of prehistoric inhabitation, several round barrows and entrenchments being visible in the



WEYMOUTH

Above. The harbour. Below: The beach.

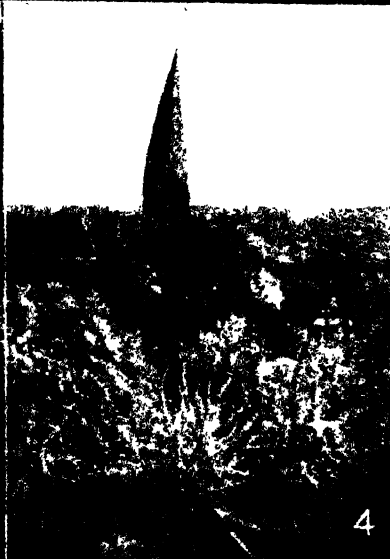
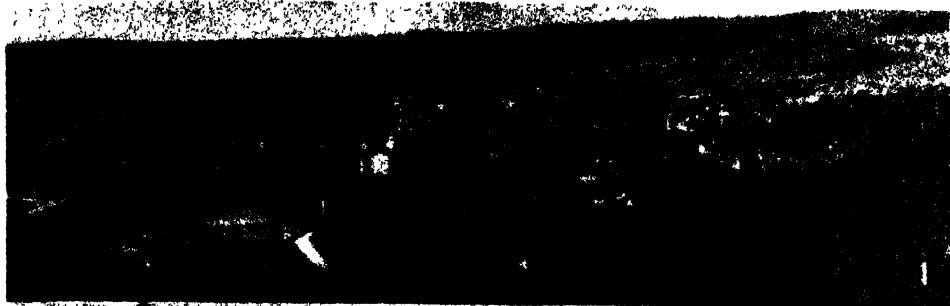
Photos: Fox; George Long

a hundred circular pits have been noted—probably the hut circles of the Celtic race who inhabited the site in the third century B.C.

Modern attractions of the town include two piers, an esplanade $2\frac{1}{2}$ miles in length and two large public parks—Grove Park and Clarence Park.

WESTPHALIA, west fay' lia, officially **WESTFALEN.** A province of Prussia, first of the provinces of Germany in the production of coal, second to the Rhine province in iron production, and also possessing valuable resources in deposits of zinc, lead, pyrites, and copper. Westphalia has an area of 7804 sq. miles, and a population of 5,039,963 (1933).

The manufacturing products include metal wares, linens, cotton and woollen goods, hosiery, paper, leather, glass, chemicals, sugar, and sausages. Rye, oats, potatoes, and flax are the principal crops. Mün-



SCENES IN WESTPHALIA

1. A general view of Arnsberg. 2. The docks at Dortmund. 3. Looking toward the centuries-old church of Saint Lambertus in Münster. Four hundred years ago the bodies of despoilers of graves used to be placed in iron cages suspended from its walls. 4. The Reformed Church at Soest. 5. The Basket Boy fountain before Fritz Wickers Inn at Münster.

Photos: German State Railways

district immediately to the east of Upwey. Weymouth itself is of Saxon origin and owes its foundation to King Ethelbert. From the twelfth to the sixteenth centuries, when Sandesfoot Castle was built by King Henry VIII, it was a vigorous port, and, at the time of the Armada, furnished six warships. After a decline it revived under the patronage of George III.

WHALE. The largest of existing animals. Though fishlike in appearance and adapted to life in the ocean, whales are warm-blooded mammals. They possess lungs and a double circulation, bring forth their young alive, and suckle them. Structurally, whales show their kinship with land mammals in many particulars. Within the two paddles of the whale are all the bones and joints, and most of the muscles, arteries, and nerves of a human arm, and deep in its body are the rudiments of hind legs. Externally, the whale differs from land mammals in having few or no hairs on its skin. The blubber, a thick layer of fat beneath the skin, serves to keep the animal warm. This blubber is the source of whale oil.

Unlike a fish, a whale cannot breathe under water, though able to stay beneath the surface for a considerable time. The flattened tail, with its horizontal flukes and powerful up-and-down movements, enables the whale to rise speedily from great depths; when it reaches the surface, it expels the air from its lungs through a nostril on top of its head with such force that the moisture of its warm breath, condensing in the cold air, rises in a column high in the air. According to some naturalists, whales may dive directly downward to a depth of 2000 ft. when they are attacked. The whale mammal can adjust itself to enormous water pressure, seemingly without difficulty.

Whales are of the order of marine mammals called *Cetacea*. This order is divided into two principal groups, or sub-orders. The *whalebones*, or *baleen*, whales constitute one group, and the *toothed whales* and their allies the other. To the latter sub-order belong sperm whales, dolphins, porpoises, and narwhals.

The whale is hunted for the valuable whalebone. The whalebone is not bone, but

a horny outgrowth from the skin, corresponding to the nails of land mammals. There are two parallel rows of thin, triangular plates of whalebone, or baleen, hanging from the roof of the mouth. The inner edges of the plates are frayed out into long fibres, or bristles, that form a hairlike mat on the inside of the mouth. One whale may yield several tons of whalebone. The whalebone whales have no teeth. To secure their food, they travel swiftly through the water with open jaws, and the fibres inside the mouth strain out of the water the millions of minute forms of sea life upon which the whales feed. The Greenland or Arctic whale is also known as the Bowhead.

Baleen Whales. The baleen group includes the *Greenland* or *Arctic right whale*, which may be 60 ft. long; the *New Zealand right whale*, which is about 20 ft. long; the fin whales, or *rorquals*; the *humpback*; and the *California grey whale*. Though possessing shorter and coarser whalebones and a scantier supply of oil than the right whale, these other species have become important in the whaling industry, because of the increasing scarcity of the right whales. One species of the rorqual, the blue whale, may reach a length of over 100 ft.

All whales are very large when born. In the larger species, they are sometimes 20 ft. to 25 ft. long at birth, and weigh tons. The calves continue to be nursed for months, sometimes for a year.

The Sperm Whale. The largest species of the toothed whales is the *sperm whale*, which attains a maximum of 70 ft. It has a blunt head, occupying about one-third of its body, within which is a huge cavity filled with an oily fluid. There are forty to fifty teeth in the lower jaw, but those in the upper jaw are rudimentary, having atrophied. The sperm whale feeds on giant squid and cuttle fish.

Whale Products. Oil from the blubber of right whales was at one time the fuel of lamps in all civilized countries. After the introduction of petroleum, whale oil lost its importance for burning, but the catch to-day is used in soap-making, for lubricating, for leather dressing, as an ingredient in margarine, and in the manufacture of



A PAIR OF WHALES
Photo: Central

glycerine for explosives. Sperm oil is of better quality than other kinds, and is used for oiling delicate machinery. From the head liquid of the sperm whale is obtained also a waxy substance called *spermaceti*, used in cosmetics. The intestines of the sperm whale sometimes secrete a fatty material used by perfumers, and known as *ambergris*.

Whalebone is used in mechanical brushes for which ordinary bristles are too soft, as stuffing for mattresses, and as material for handles on canes and umbrellas.

Cattle and chicken food is made from whale flesh and bone, and various parts of

the blubber into sections to be pulled by the steam winch to the deck of the whaling steamer, or the wharf of a whale-oil factory. First one side is stripped, then the other, and the blubber is boiled for oil and fertilizer. Factory steamers, built and equipped to dispose of the catch far from shore, are used in the Antarctic and some other whaling regions.

The most important whaling grounds of to-day are in or near the Antarctic waters, especially near Ross Sea, off the south-east coast of Chosen; off the California coast, off the Azores Islands; and in Alaskan waters.

Scientific Names. Whalebone whales constitute the sub-order *Mystacoceti* and the toothed whales, sperm whales, bottle-nosed whales, etc., the sub-order *Odontoceti*.

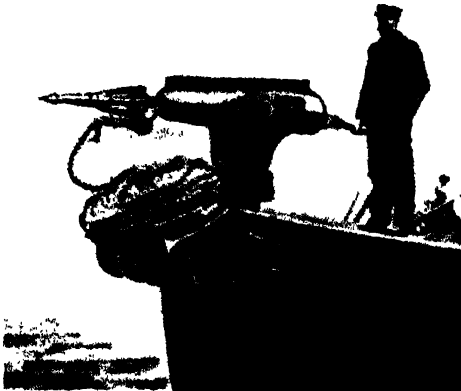
WHARF. A structure on the shore of a river or harbour used for loading and unloading vessels. See DOCK.

WHEAT. The most widely cultivated of the food cereals, which furnishes bread or its equivalent to more than 600,000,000 people. More than two bushels per head of the world's population is produced. Every month of the year marks the time of wheat harvest for some part of the world—from the month of January in Australia and South America, and from May in China, to July and August in the United States, Canada, and North Europe, and to December in India.

It is probable that wheat was cultivated before history began to be written. Specimens of wheat have been found in relics of the prehistoric Swiss lake dwellers, and in an Egyptian pyramid more than 5000 years old. Its original habitat cannot be determined, but it is thought to have evolved in central or south-western Asia. It furnished the staple food of the ancient Egyptians, Assyrians, Greeks, and Romans. The relatively high value of wheat among the Hebrews is often mentioned in the Bible. As the choicest gift of the harvest, it was used in the sacrifices of the ancients, and it is still held sacred in parts of China.

Wheat is a member of the cereal grasses, and has the chief characteristics of that family (see GRASSES). More than 200 varieties of wheat are grown.

The heads may be bearded, with long, hairlike extensions of the chaff which surrounds each kernel, or they may be beardless. The kernels may be white or reddish, and the chaff may vary from nearly white to brown or black. Kernels may be soft and starchy, making them suitable for bread- or pastry-making, or they may be very hard, with high gluten and low starch content, which fits them for macaroni and similar pastes.



HARPOON GUN

Photo Visual Education Service

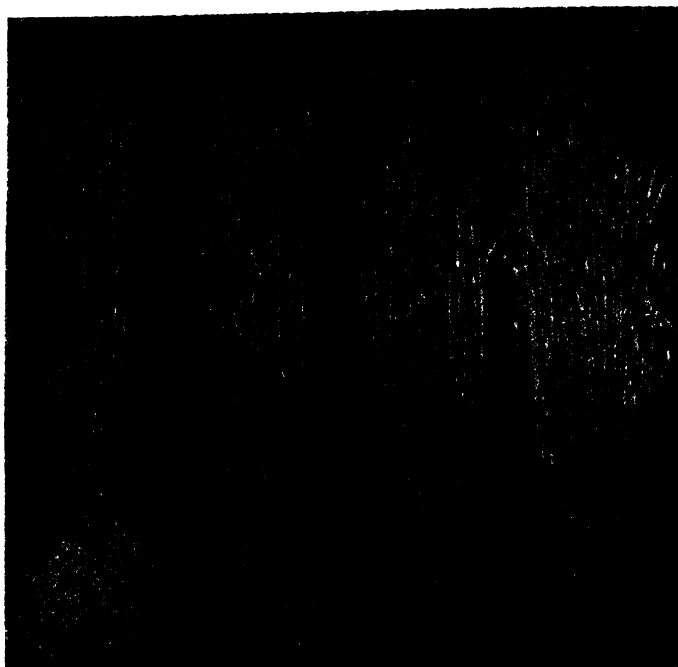
the carcass are converted into fertilizer. The bone is rich in phosphates.

Whaling Industry. The early centres were situated in eastern Europe and western North America, but with the depletion of the stock of whales and the introduction of larger ships and better equipment, the main whaling centres shifted further north. In the early days the harpoons were then thrown from small whale boats, and many were the exciting struggles before a whale was killed. With the development of steam navigation and the invention of the harpoon gun, in 1865, whaling methods changed altogether. The modern harpoon, dispatched from a gun and equipped with a bomb which explodes in 3 sec. after the whale is struck, usually kills its victim instantly. After the whale is dead, the body may be hauled to the surface by a steam winch, for most species, except sperm and right whales, sink when killed. Then the carcass is inflated by means of a tube and rubber hose attached to an air pump, until it floats like a balloon. It is then ready for the "flensers," who cut

The most important classification to the grower, in most instances, is that which labels the wheat as *spring wheat* or *winter wheat*. Spring wheat is sown early in the spring and matures late in summer. Winter wheat is sown in autumn, starts to grow before winter, and when cold weather begins, lies dormant in the soil until spring. This type is used where the winters are not too severe, and in moderate climates such as

yellow, and the milky fluid which fills the young kernels has turned hard, the grain is ready to harvest.

The U.S.S.R. leads the world in the amount of wheat produced; more than 27,292,000 tons yearly. The U.S.A. ranks second, while India and France hold third and fourth places in the world's output. Canada, Argentina, Italy, Spain, Germany, and Australia follow in that order. Europe,



Chalk Sand Clayey Sand Clay

THE RESULTS OF WHEAT GROWN UPON VARIOUS SOILS

that of Great Britain both varieties are raised in the same district.

Wheat responds quickly to good soil management, and selection and cross-breeding have produced many valuable and hardy types with large yields. The grain thrives best when the growing season is cool and only moderately moist, with a warm, dry season for its maturing and harvesting. It grows best in a rich alluvial soil or fertile clay loam, and when crops are not rotated, and the soil is not rich in humus, the use of fertilizers increases the yield to a considerable degree.

The seed is planted in rows about 6 in. or 7 in. apart, or sowed broadcast. Wheat grows so strongly and thickly, crowding out most weeds, that intertillage is rarely attempted. When the heads of the wheat turn

including Great Britain and Ireland, produces more than half of the total wheat output of the world.

Besides its most important use in the making of flour, wheat is prepared in various other ways as food. The milling products known as *bran*, *shorts*, and *middlings* are used as stock feed. They are also used in the manufacture of breakfast food, either finely ground, or rolled, flaked, and cooked.

The use of wheat for the manufacture of starch dates back to ancient Egypt. It is still used for the best laundry work. The making of macaroni and similar products is an important industry in the Mediterranean and Black Sea regions, where the hard durum wheats were developed.

Scientific Name. Wheat belongs to the grass family, *Gramineae*.

WHEATEAR. A bird closely related to the whinchat and stonechat. Its name probably originated in an old Saxon word meaning white rump, which is the bird's most characteristic feature in the field. Numerous species of wheatear are found in



COCK WHEATEAR AT NESTING HOLE
Photo E. J. Hosking

Europe, Asia and North America, and in Africa.

In Britain the common wheatear is the earliest arrival of the summer visitors. It begins to appear in numbers early in March. It is a bird of open country and hillsides.

Scientific Name. *Oenanthe oenanthe*.

WHEEL AND AXLE. A mechanical device employed in lifting weight. In its simplest form it consists of a cylinder and a wheel of larger diameter, or a crank, fastened together and turning on the same axis. The wheel and axle is one of the simple mechanical powers (see LEVER), and is regarded as a perpetual lever, the centre of the axle corresponding to the fulcrum, the radius of the axle to the weight arm, and the radius of the wheel to the force arm.

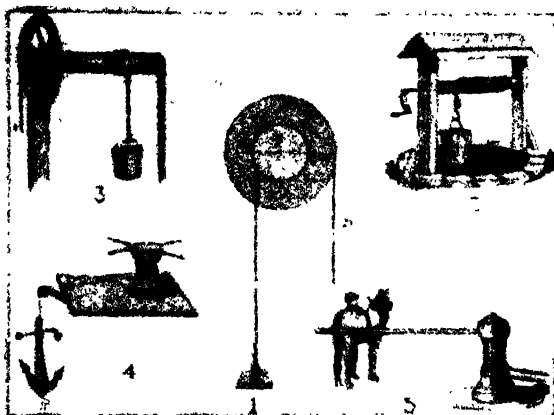
The mechanical advantage of the wheel and axle is based on the law: *The force applied multiplied by the radius of the wheel equals the weight multiplied by the radius of the axle.* Reduced to a formula, it is written thus: $P \times R = W \times r$,

or $\frac{W}{P} = \frac{R}{r}$. The mechanical advantage is equal to the radius of the wheel divided by the radius of the axle, or $\frac{R}{r}$. In other words, disregarding friction, the effectiveness of a wheel and axle is increased tenfold if the radius of the wheel or crank is ten times the length of the radius of the axle.

The most common uses of the wheel and axle are illustrated: Fig. 1 illustrates the principle on which the device works. Fig. 2 is the ordinary axle and crank, or windlass, for raising water from a well. The hand applied to the crank is the force, and the bucket of water the weight. Fig. 3 shows a similar device with a wheel and rope in place of the crank. Fig. 4 is a capstan used in raising an anchor. The force is applied to the handspikes, which radiate from the capstan like spokes from the hub of a wheel. Fig. 5 represents the capstan often employed in moving buildings.

WHIG, originally **WHIGG**. A shortened form of *whiggamor*, applied in Scotland to drivers of horses, later to the west-country Presbyterians, and then to the Scottish insurgents in the reign of Charles II. After 1679, the name Whig was applied in England to those who belonged to the Country Party and were opposed to the succession of the Catholic James, Duke of York. The party is older than any of its names, for its strongest elements—the great magnates, the urban middle class and the Dissenters—can be found in the Parliamentary ranks opposed to Charles I.

In 1679 the Earl of Shaftesbury was the leader of the Whigs, but Charles II proved an adroit politician and Whiggism languished. It was revived by the tactless blundering of James II, the old cry that



WHEEL AND AXLE
Explanation appears in the text

England's Church and Liberties were in danger raised many supporters, and William of Orange was welcomed.

The Bill of Rights clipped the powers of the Crown, but William remained a dominant character. It was not till George I ascended the throne that the Whigs really

triumphed, for Anne, susceptible as she was to personal influence, would not be controlled by a party. As George I did not talk English, the Sovereign was shut out from council meetings and from the discussion of domestic affairs. For fifty years



WHINCHAT

Photo E. J. Hocking

Britain was ruled by a close oligarchy of great families who controlled the Commons by bribery. England suffered much from the Whig domination. The magnates were in alliance with the merchants and the result was the crippling of Irish and colonial trade in the interest of that of England. A ludicrous Poor Law pauperized without adequately aiding the poor. As the Industrial Revolution developed, the factories were allowed to become places of horror, for the Whig theory of non-intervention by the State left the working-class open to be exploited.

George III, by taking over patronage and reviving the Tories, shook the Whig oligarchy, but his disastrous war with America weakened his own position. The Whigs now began to point out the evils of bribery and might have agitated for reform if the French Revolution had not scared many of them into the Tory Party, which they gradually transformed. In the early nineteenth century there was often more difference in outlook between the Whig and the Radical than between the Whig and the Tory. The Reform Bill of 1832 admitted the middle classes to a share in the power, and the differences between the parties depended largely on the economic problems of Free Trade. At about this period the older party names began to drop into disuse.

WHIMBREL. A large wader related to the curlew (which see). Both these birds have an unmistakable long decurved bill, and their habits and general appearance are very similar. The whimbrel can be distinguished by its smaller size and the dark and light stripes on its crown. It breeds farther north, generally in sub-arctic regions, and occasionally in Scotland. In other parts of the country it is a fairly common migrant in spring and autumn.

Scientific Name. *Numenius phaeopus*.

WHINCHAT. A bird closely related to the stonechat, and to a lesser extent the wheatear. The whinchat may be distinguished from the stonechat by its distinct pale "eyebrows" and buff breast. It is found in rough waste country.

Scientific Name. *Saxicola rubetra*.

WHINSTONE. A popular and engineering term for dark-coloured rocks such as basalt, dolerite, diabase, greenstone, and lamprophytes. In other words it is the rock known as trap. The term whinstone should be applied (geologically) only to stone from the whin sill.

WHIP, PARLIAMENTARY. This name, short for "Whipper-in," a term used in hunting, is also used for officials responsible for party discipline. A "whip" is the term used for a note requiring attendance at the Commons for a particular debate. A "three-line whip" is the term used of the most urgent of such votes.



WHIPPET

Photo: Fall

WHIPPET. A wiry dog having the appearance of a small greyhound. It is a cross between the Italian greyhound and the terrier.

WHIPPING POST. An old instrument for the infliction of corporal punishment, which,

like the ducking stool, long since disappeared from most countries. A number of village whipping posts are still preserved in rural districts, often in association with stocks (which see) Haxering-atte-Bower in Essex and Aldbury in Hertfordshire contain notable examples.

WHIRLPOOL. An eddy or vortex of water. A spinning motion is imparted to water by the striking of the current against a bank of peculiar formation, by the meeting of two currents, or by the action of the wind.

WHIRLWIND. A circular or spiral movement in the air, caused by the sudden rising of an overheated layer of surface air into the heavy, cooler atmosphere above. Whirlwinds occur most frequently in the deserts, where the sun heats the air near the ground to a very high temperature. The motion of the air as it rises can be seen, because it often carries sand and dust more than 1000 ft above the earth.

WHISKY. An alcoholic liquor distilled from malt, grains, or potatoes. The whisky produced in Scotland and Ireland is malt whisky, and is made chiefly from barley malt.

In the process of whisky manufacture, barley, wheat, or potatoes are boiled until a mash is formed, malt is then added, to convert the starch into sugar. Yeast is added to produce fermentation, and the process is continued until the sugar has been converted into alcohol. The alcohol is then separated by distillation.

WHIST. A game, played with a full pack of fifty-two cards, which rank from the ace downwards in sequence. The game is for four players, two pairs of partners. The cards are shuffled, cut for trumps, and dealt one at a time to each player in turn. The player next to the dealer, on the left, commences the game by leading a card, the other players following in order from left to right. The four cards played constitute a trick.

The object of the game is to take as many of the tricks as possible. Players must follow suit when they can do so. Having no card of the suit led, a player may discard a card of another suit, or he may play a trump, which takes the trick, unless a subsequent player plays a higher trump.

The winner of the trick always leads another card from his own hand, until thirteen tricks have been played. The side that takes most of the tricks counts one for every trick taken, above the number of six.

WHISTLER, JAMES ABBOTT McNEILL (1834-1903). A versatile American artist who gained distinction in etching, pastel, oil painting, and water colour. He was born at Lowell, Massachusetts.

At the age of 9 he was taken to Russia and attended the Imperial Art Academy of St. Petersburg (now Leningrad). He began the serious study of art in 1856 in Paris, and in 1859 removed to London where he lived for the greater part of his life.

Whistler early won notice as an etcher. His first important views, "Little French Series" (1858), were greatly admired, and his reputation was further enhanced by a series illustrating scenes along the Thames, begun after his removal to London. Probably the best-known of his portraits in oil is the picture of his own mother (Louvre, Paris)—a charming study in grey and black. An idealized portrait of Carlyle may be seen in the Glasgow Museum.



WHISTLER
Photo. Brown Bros.

His landscape and marine views include "The Thames in Ice" and "Southampton Water."

WHITBY, SYNONYM. A conference summoned in 664 by Oswy, King of Northumbria, to bring about agreement in matters of authority and practice between the adherents of Celtic and Roman observance. The former had been practised in England long before Augustin was sent from Rome by Gregory the Great, but it derived its chief impetus from the foundation of a monastery at Iona by Columba, an Irish nobleman. This Irish Christianity had spread over Western Scotland and had been introduced into Northumbria by Aidan, a monk of Iona, in the reign of Oswald. The religious observance of Aidan, however, varied in certain minor respects from that of the Augustinian Church, notably in the dates of the observance of Easter. The Irish cause was pleaded by Aidan's successor Colman, and the Roman by Wilfrid of York. Oswy, who had supported the church of Iona, surprisingly decided in favour of Wilfrid.

WHITE, GILBERT (1720-1793). An English naturalist, famous as the author of the *Natural History of Selborne*, which, since its publication in 1789, has retained its popularity. This work is an account of White's close observation and intimate association with nature during his quiet, scholarly life in the town of Selborne, Hampshire, where he was born.

WHITE, WILLIAM HALE (1829-1913). An English author who wrote under the pen

name of "Mark Rutherford." His earliest works are, perhaps, his best known; they include *The Autobiography of Mark Rutherford*, *Mark Rutherford's Deliverance*, and *The Revolution in Tanner's Lane*.

WHITEBAIT. See HERRING.

WHITEFISH. A group of fresh-water fish of the salmon family, inhabiting lakes and streams in the northern regions of Europe, Asia, and North America. The common whitefish has an elongated, compressed body, a cone-shaped snout which projects beyond the lower jaw, a small, toothless mouth, and a forked tail. The colour is bluish-olive above, and silvery below and on the sides. Average specimens weigh 4 lb.

Scientific Name. All of the whitefish are members of the genus *Coregonus*.

WHITE LEAD. A pigment extensively used in the manufacture of white paint. It is a mixture of lead hydroxide (lead, oxygen, and hydrogen) and lead carbonate (lead, carbon, and oxygen). White lead is prepared by several processes, the oldest of which is the so-called Dutch method. Coils of sheet lead are placed in earthen pots which contain a weak solution of acetic acid. The pots are then buried in spent tan bark in a chamber where steam and air act upon the substances. In the course of about three months, all the lead is changed to white lead, which is in the form of powder. This is then ground in linseed oil, to form the white paint of commerce. Some modern methods of manufacture are by electrical processes, which show a considerable saving of time by comparison with the Dutch method.

WHITE RUSSIA. A Republic of the U.S.S.R., with an area of 48,751 sq. miles, lying east of Poland and Lithuania. Most of it is a plain area with considerable forests and much cultivation of rye, wheat, flax, and potatoes. There are also many cattle, sheep, and pigs. The population in 1933 was 5,439,400. Minsk with a population of 180,000 is the capital.

WHITE SEA. An arm of the Arctic Ocean, extending into Northern Russia. The Onega, the Dvina, and the Mezen are the principal rivers which flow into it, and Onega and Archangel are the largest cities on its shores. The Dvina, Volga, Dnieper, and connecting canals permit uninterrupted navigation between the White, Caspian, and Black seas. Thus, although the White Sea is only free from ice for four months in the year, it is an important channel of communication.

WHITETHROAT. A small warbler (which see) which is distinguished from the others of this group by its white throat and breast. There are two species more or less confined

to Europe. They are both fairly common in Britain, particularly southern districts. The Lesser Whitethroat can be distinguished from its rather larger relative by its dark "eyebrows" and the lack of rufous colour on its wings.

Whitethroats are birds of the hedgerows and shubberies and, like other warblers, rather inconspicuous in their colouring but less



WHITETHROAT
Photo E. J. Hesking

skulking in their habits. Both species are summer visitors from April to August.

Scientific Names. Whitethroat *Sylvia communis*. Lesser Whitethroat *Sylvia curruca*.

WHITGIFT, JOHN (1530-1604). Archbishop of Canterbury. He was born at Grimsby and educated at Pembroke Hall, Cambridge. He entered the Church and became chaplain to the Bishop of Ely. Later he returned to Cambridge as Lady Margaret Professor of Divinity. In 1566-67 he was Master of Trinity College, and ten years later Bishop of Worcester. He became Archbishop in 1583.

Whitgift was one of the most vigorous personalities in the history of the Church of England, and played a most important part in the settlement under Queen Elizabeth, whose confidence he enjoyed to the full. He was inclined doctrinally towards Calvinism, but nevertheless insisted on the need for complete ritualistic uniformity. The "Martin Marprelate" tracts, published by John Penry and others after 1586, were largely aimed against the Archbishop and his uncompromising episcopalianism.

Whitgift was a member of the Hampton Court Conference of 1604, which reaffirmed the episcopalian basis of the Anglican Church, and decided to have a revision of the Bible prepared (the "Authorized Version" of 1611).

WHITMAN, WALT (1819-1892). An American poet, of Dutch and English ancestry, born at West Hills, on Long Island. He became in turn carpenter, typesetter, and journalist. His democratic training coloured his outlook for the whole of his life. His

first collection of poems, *Leaves of Grass*, earned him widespread ridicule. Later criticism was more favourable, and his work was well received by critics such as Ruskin and Carlyle. He endeavoured to express naturally his beliefs in individual freedom and the brotherhood of man, and was interested in tracing these ideals in his country's development. Frank and unconventional in content and style, lacking metre and rhyme, yet possessing original force and sureness of insight, his poetry has always aroused controversy, but remains one of the most characteristic productions of American literature.



ELI WHITNEY
Photo: Brown Bros

WHITNEY, ELI (1765–1825). Inventor of the cotton gin, he was born at Westboro, Massachusetts. He became a school teacher. His machine for separating the seed from cotton took shape in 1792, and with it one man could clean 1000 lb in

the time formerly required to clean 5 lb by hand. During his life he received little reward and less credit for his invention, but its importance is now fully recognized.

WHITTINGTON, RICHARD (died 1423). Mayor of London. He was the son of Sir William Whittington. A mercer, he occupied the mayor's office three times, in 1397–8, 1406–7, and 1419–20. The legend which has attached itself to the name of "Dick" Whittington appears to date from 1605, when the familiar story of a cat helping to bring success to its owner was dramatized. The story runs that Whittington, in the service of a merchant, Mr. Fitzwarren, ventured his cat as part of a trading cargo. The cat was bought for a large sum by the King of Barbary whose country was plagued with rats and mice. "Dick," ill-treated by Mr. Fitzwarren's cook, ran away, but fancying he heard Bow Bells ringing a summons to return, "Turn again Whittington, Lord Mayor of London," he obeyed and found fortune awaiting him. Whittington was a generous benefactor and left legacies for the rebuilding of Newgate Prison, the foundation of an almshouse, and other useful purposes.

WHOOPIING COUGH. A highly contagious disease of which children are most often the victims. Its chief danger arises from complications such as bronchitis and pneumonia, lung and brain haemorrhage, and convulsions. The early symptoms are slight fever and a dry cough. At a later stage the symptoms are aggravated at night and appear in paroxysms. The characteristic "whoop" does not generally appear until a week or more has elapsed. The climax of the disease occurs about the end of the fourth week, after which the paroxysms gradually diminish in number and severity. Fresh air and nourishing food are prescribed in treatment.

WHORTLEBERRY, *hwar' t'l ber ri*, OR **HUCKLEBERRY.** A shrub belonging to the heath family, of which several species are known. The fruits of some varieties are edible.

Scientific Name. The whortleberry belongs to the family *Ericaceae*.

WICK. A borough and county town of Caithness and the most important centre of population in the northern counties of Scotland, with a population of 7548 in 1931, situated at the terminus of the L.M.S. Railway, 729 miles from London. The principal industry is in connection with the herring fishing for which it is one of Scotland's largest ports. The modern Town Hall and the Sheriff court buildings are among the most interesting buildings, but are comparatively modern. The old town round the



WICK HARBOUR
Photo: Taylor

harbour contains many picturesque houses of the seventeenth and eighteenth centuries. The site is also of great antiquarian interest for it seems to have been one of the chief

centres of culture in prehistoric days, and many Pictish cairns and brochs have been excavated in the district. In recent years the town has attracted a steadily growing number of holiday-makers.

WICKLOW. The capital of the county of the same name in Leinster, Irish Free State, with a population of 3025. It is 28 miles from Dublin, on the G.S. railway. It stands at the mouth of the River Vartry. Its trade and industries are small.

WIDGEON, *wij' un*. See **WIGEON**.

WIDNES. On the north bank of the River Mersey, about 12 miles higher up the river



A CORNER OF WIGAN
Photo: Photopress

than Liverpool, and 20 miles from Manchester, with a population of 42,100. Widnes is served by the L.M.S.R. and L.N.E.R. The town is adjacent to many sources for the supply of raw materials, including the South Lancashire coalfield, and the industries are many and varied. Manufactured goods include asbestos, cement, chemicals, soap, paints and oils. Up to the time that the canal was extended to the town in 1830, Widnes was an agricultural district, but some twenty years later, with the establishment of chemical industries, the town began a very rapid industrial growth. Spanning the river estuary between Widnes and Runcorn is the Transporter Bridge, which is extensively used for goods and passengers.

WIEN, *veen*. See **VIENNA**.

WIESBADEN, *vees' bah den*. See **GERMANY**.

WIFE. See **HUSBAND AND WIFE**.

WIG. A contraction of the word *periwig*. Wigs have been discovered on the heads of Egyptian mummies. They were used by many ancient peoples, including the Persians, Greeks, and Romans. Modern wigs date from the seventeenth century, having originated in France. At first, there was merely an attempt to provide a full head of hair, but subsequently, wigs were made so that

the hair fell below the shoulders. The wigs of English barristers are a survival of the full-dress wig of Queen Anne's reign. General use of the wig ceased with the French Revolution, and is to-day confined to the stage and to concealing loss of real hair.

WIGAN. Halfway from London to Scotland on the main line of the L.M.S.R. is the county borough of Wigan, with a population of 85,357. It is also midway between Liverpool and Manchester, and less than 20 miles from Preston. There is an abundant supply of coal from the adjacent South-West Lancashire coalfield, its chief industries being the coal, cotton, and engineering trades. Wigan is one of the ten oldest boroughs in England, its earliest Charter being granted by Henry I in 1100. The town acquired fame in the Civil Wars through its loyalty to the Royalist cause, and was the site of the Battle of Wigan Lane in 1651, when Lord Derby was defeated before being executed at Bolton. The town's most interesting link with the past is the Parish Church, the date of the foundation of which is unknown. The present structure is fourteenth century.

WIGEON, *wij' un*. A duck of the north temperate regions. There is a species which breeds in northern Europe and Asia, and spends the winter in sub-tropical regions, and a related species in North America. In Britain the wigeon is common as a breeding bird in Scotland and as a winter visitor in southern parts. It usually nests inland, in rough open country, but in winter it is generally seen on sea coasts.

The wigeon is smaller than the common mallard and rather larger than the teal. The plumage is less colourful than either of these. In the male the bill is blue and the head and neck chestnut. There is a conspicuous white patch on the wing and the speculum is green and black. The colours of the female are less conspicuous.

Scientific Name. The European type is *Anas penelope*.

WIGHT, ISLE OF. An island off the south coast of England, forming part of Hampshire, from which it is separated by the Solent, a strait from 2 to 5 miles wide. The island covers an area of 147 sq. miles. A range of chalk cliffs, visible for many miles, traverses it irregularly from east to west. The chief town is Newport, and the chief port is Cowes, internationally famous for its regatta; Ryde, Shanklin, Ventnor, and Sandown are other well-known and popular resorts. There is regular steamship communication with Southampton, Portsmouth, and Lymington, and a railway system connects all the important points on the island. The chief industry is agriculture; sheep-raising is extensive, and the wool is noted



ISLE OF WIGHT

1 Ventnor Pier. 2 Shanklin. 3 Sandown, looking towards Culver Cliff.

Photos: Fox; Central; Taylor

for its purity. The population is 88,400 (1931). The island contains many relics of Roman occupation, and was the scene of almost incessant warfare for several centuries. Carsbrooke Castle was the prison of King Charles I during his struggle with Parliament.

WIGTOWN. A maritime county at the south-west extremity of Scotland, earlier known as the western division of Galloway. The coast line is bold and rocky, the famous headlands including the Mull of Galloway (which is the most southerly land of Scotland), Corsewall Point, and Burrow Head. It is peculiarly irregular in shape. The Mull of Galloway is at the western end of a great open waterway only 16 miles long, but 13 miles broad. These notable headlands are generally known as the Rhyns (or Rhinns) of Galloway.

This territory was occupied by the Romans about A.D. 79, and they continued in possession until A.D. 400, when the Anglo-Saxons drove them off. During the Roman occupation, in A.D. 397, St. Ninian introduced

Christianity. He founded the monastery of Whithorn. The name Galloway—"the country of the Gall"—marks the conquest of the district by the Picts from Ireland and the Isle of Man. They held the territory during the ninth and tenth centuries, but in the twelfth century Alexander II of Scotland took possession of it.

Wigtown has important and interesting industries, which include a large output of famous cheese made by the farmers of the Rhyns district. Excellent cattle stock is bred; also horses, pigs, and sheep; and at mills at Kirkcowan and Mimmigaff, and elsewhere, tweeds and blankets are manufactured. There are few minerals. A fisheries interest is most active at Stranraer and Wigtown and the three ports—Stranraer, Wigtown, and Whithorn—prosper with a substantial shipping trade, small coastal steamers mostly making these their places of call.

Generally the surface of the territory is level, especially near the coasts. The interior is higher, but the hills, free from rocks and

covered with heather and moss, have modest altitudes. The highest hill, Larg, rises to 1758 ft., but the two next highest, Nachrun Fell and Knock of Luce, only just rise above



NEWTON STEWART, WIGTOWN
The main street and Town Hall.
Photo. Taylor

1000 ft. There are three useful rivers: the Cree, Bladenoch, and Tarff. Wigtownshire has a length of 32 miles with an extreme breadth of 28 miles, and a population of about



MULL OF GALLOWAY, WIGTOWN
Photo. Taylor

30,000. For Parliamentary purposes Wigtownshire is joined with the County of Galloway in returning one member.

WILBERFORCE, WILLIAM (1759-1833). Philanthropist and social reformer, he was born of a wealthy Yorkshire family, his father being a prosperous merchant of Hull. While he was still an undergraduate at Cambridge, he inherited a large fortune on the deaths of a

grandfather and an uncle. He entered Parliament at the age of 21 as member for Hull, and quickly became a prominent figure in the political and fashionable society of London. While on a Continental tour during 1784-85, in company with the Rev. Isaac Milner, he decided to dedicate his life to the service of religion and humanity, and on his return used his influence in Parliament to promote legislation for the suppression of vice and blasphemy. In 1787, in alliance with Granville Sharp and Thomas Clarkson, he began his great crusade for the abolition of slave-trading. He was indefatigable in speaking, writing, and lobbying in the cause, being known as the "member for abolition." Though he suffered many setbacks, he succeeded at last, in 1807, in securing the passage of an Abolition Bill through the House of Lords. The victory of Wilberforce was only partial, because, although the importation of slaves into British territory was now made illegal, slave-holding was still permitted. Moreover, elsewhere than on British territory, the traffic in slaves went on. Wilberforce, therefore, applied himself to the further and even more difficult task of abolishing slavery itself. In his efforts he wore out his strength and retired from Parliament in 1825, leaving his cause to be advocated by others. He lived just long enough to see the dawn of freedom, for on the 26th July, 1833, the House of Commons passed the Second Reading of a Bill for the Abolition of Slavery. Three days later Wilberforce died.

The great abolitionist took an active part in numerous other social and religious movements, for example, the Church Missionary Society, the Bible Society, and the Society for the Reformation of Manners. Most of his private fortune he used for charity.

WILD CAT, OR CATAMOUNT. Terms applied generally to small, wild species of the cat family, and in North America given to three small species of lynx. See **LYNX**.

The true wild cat is the European species, an extremely vicious animal, larger and stronger than the domestic cat, with yellowish fur and black streaks around the body, legs, and tail. Of the numerous tropical species, the most interesting is the Egyptian



WILLIAM WILBERFORCE
(National Portrait Gallery)

cat, said to be the ancestor of the domestic varieties. Unlike other wild cats, it has a long, slender tail. Its fur is yellowish in colour and obscurely striped on body, legs, and tail. The feet are black.

Scientific Name. Wild cats belong to the family *Felidae*. The European species is *Felis catus*.

WILDE, OSCAR FINGALL O'FLAHERTIE WILLS (1854-1900). Dramatist, poet, essayist, novelist, and critic, born in Dublin, Ireland. His father was a surgeon, and his mother a poet. From both he inherited the genius which made him famous. At 17, he entered Trinity College, Dublin. In 1874 he continued his studies at Oxford, where he started a notable artistic movement which was

satirized in Gilbert and Sullivan's opera, *Puissance*. Wilde won the distinction of the Newdigate Prize for English verse, and became well known as a journalist and lecturer. Later, he lived in Paris, and was associated with Daudet and Sarah Bernhardt. Returning to London, he became a successful playwright, but his brilliant career was cut



OSCAR WILDE
Photo Brown Bros.

short by prosecution for immoral conduct in 1895.

Beginning in 1881 with a book of poems, he wrote two delightful collections of fairy stories, *The Happy Prince* and *The House of Pomegranates*; a novel, *The Picture of Dorian Gray*; a one-act play, *Salome*, in which Sarah Bernhardt played in Paris and which was staged in Berlin by Max Reinhardt; brilliant essays under the title *Intentions*; a play, *Vera*, and four popular society dramas, *Lady Windermere's Fan*, *A Woman of No Importance*, *The Importance of Being Earnest*, and *An Ideal Husband*, his greatest poem, "The Ballad of Reading Gaol"; and *De Profundis*, which has been called the biography of his soul.

WILHELM. See WILLIAM (I, II, Germany).

WILHELMINA, *vi hel me' na* (born 1880). The only daughter of William III of the Netherlands, and of Emma, daughter of Prince George Victor of Waldeck, she succeeded her father as sovereign of the Netherlands in 1890. As she was only 10 years old at the time, Queen Emma acted as regent until 6th September, 1898, when Wilhelmina was formally crowned queen in

Amsterdam. Three years later, she was married to Henry, Duke of Mecklenburg-Schwerin, a German prince (died 1934). Juliana, their daughter and heiress to the throne of Holland, was born in 1909, and in 1937 was married to Prince Bernhard of Lippe-Detmold.

WILKIE, SIR DAVID (1785-1841). A painter who is noted chiefly for his sympathetic and charming pictures of Scottish life and scenes. He

was born at Cults, Fifeshire, and received his art training in Edinburgh and in the Royal Academy schools, London. Wilkie's first important picture—"Village Politicians"—was exhibited in 1806. This was followed by "Blind Fiddler," "Village Festival," "The Bagpiper," "Rent Day," and others, all characterized by humour, simplicity, and a kindly realism. In 1809 Wilkie was made an associate of the Royal Academy, and two years later became a full member. In 1830 he was appointed court painter, and six years later was knighted. In his later years, he attempted historical pictures and portraits, but was less successful than in his particular field of portraying everyday life. He died while on a trip abroad, and was buried at sea.

WILKINS, SIR GEORGE HUBERT (born 1867). An Australian scientist and explorer. He was born at Mount Bryan East, in South Australia, and educated in the Adelaide School of Mines. In the Balkan Wars, 1912-13, he was employed by a newspaper as a war photographer.

In 1913 Wilkins was official photographer in the Stefánsson Arctic expedition and rose to the position of second in command. On the outbreak of the World War, he returned to Australia and joined the Australian Flying



QUEEN WILHELMINA
Photo Brown Bros.



SIR DAVID WILKIE
Photo Brown Bros.

Corps. He served in France on the western front and was awarded the Military Cross with one bar.

In 1920 he was second in command of the British Imperial Antarctic Expedition to Graham's Land, and in 1921 he was naturalist with the Shackleton expedition. After two unsuccessful attempts to fly across the Arctic in 1928 Wilkins made a flight from Point Barrow, Alaska, to Spitsbergen, a distance of 2200 miles, in 21½ hrs.

A second venture of 1928 was an expedition to the South Pole, in which Sir George established a base at Deception Island and began exploring the Antarctic by aeroplane. In 1931 he set out to explore the Arctic further by sailing under the ice pack of the Polar Sea in a submarine. When within about 400 miles of the North Pole, a series of mishaps forced him to turn back. He was a member of the Ellsworth Antarctic Expedition in 1933-34.

WILL. In psychology, that form of mental activity which is concerned with choice and action. Every idea impels to action, and we should carry every idea into action if environment or inhibiting ideas did not restrain us.

The strongest power the will exercises is that of control. It not only starts action, but it can also arrest it. The function of inhibition is twofold—to prevent mental exhaustion by closing the mind, as it were, to the many impressions made upon it in daily life, and to give self-control. If we acted upon every impression brought into consciousness, both physical and mental exhaustion would soon follow. Inhibition controls our action and leads us to expend our energies upon those things that we think will be most interesting and beneficial to us. Moreover, it enables us to control our emotions. Like other activities of the mind, the will is developed by exercise.

The following considerations will be found helpful to parents and teachers—

Imitation. "Imitation is an instinct; suggestion is an impulse." The tendency to repeat what another does is universal; hence the power of example. It naturally follows that only correct models should be placed before children.

Suggestion. Imitation is repeating an act; suggestion is carrying out an idea. See UNCONSCIOUS.

Effort. The necessity of having children and young people act on the choices they make cannot be emphasized too strongly. Decision must be accompanied by determination and followed by action, if any benefit is to be derived from it. Give children work within the limits of their capacity and hold them responsible for their tasks.

WILL. A document containing any person's directions as to how his estate is to be dealt with after his death. In order that a will should be valid in English law it is necessary (a) that the testator (i.e. the person making the will) should be of full age and of sound mind and not acting under duress or undue influence; and (b) that it should be signed by the testator and by two witnesses, all of them in each other's presence. The witnesses should not be persons to whom any benefit is given by the will. Members of the armed forces, on active service, may make a will whether over or under 21, and either in writing, with or without witnesses, or orally before witnesses. A will may be revoked by the testator (a) by destroying it; (b) by marriage (on marriage, any existing will is automatically revoked); (c) by making a new will containing a declaration that any previous will is revoked; or (d) by making a new will containing no express words of revocation, but disposing of the testator's property in a way inconsistent with the earlier will. A testator who wants to make some small addition or alteration to his will should effect this by making a codicil to his will. See EXECUTOR; LEGACY; PROBATE; TRUST.

WILLESDEN. Six miles north-west of London, with a population of 202,505, this is a great railway junction (L.M.S.R.), while the L.N.E.R. and Metropolitan line also serve the district. It an important industrial area, and a large variety of goods including motor-cars, electrical switchgear and equipment, and biscuits, are manufactured. The Parish Church of St. Mary is said to stand on the site of a church dating back to the early twelfth century. The Borough of Willesden comprises Brondesbury, Brondesbury Park, Cricklewood, Dollis Hill, Harlesden, Kensal Rise, Kilburn, Neasden, and Willesden Green.

WILLETT, WILLIAM (1856-1915). An architect and builder, he won posthumous fame by the adoption in 1916 of his "Daylight Saving" or "Summer-Time."

WILLIAM I, "THE CONQUEROR" (1027-1087) King of England from 1066 to 1087. He was born at Falaise, the bastard offspring of Robert II, Duke of Normandy, and Arletta, the daughter of a tanner. Notwithstanding his illegitimacy, William succeeded to the dukedom at the age of 10, his father having died on his return from a pilgrimage to the Holy City. It was not for another ten years that he was able with the assistance of his overlord, the King of France, to assert his full authority in Normandy against the rebellious barons, whom he defeated at Val-ès-Dunes.

Edward (the Confessor) and Alfred, the



THE NORMAN CONQUEST, AS PICTURED BY THE BAYEUX TAPESTRY

1. Harold's oath to William. 2. Funeral of Edward the Confessor. 3. Coronation of Harold
4. William's transport service gathering supplies. 5. William's forces crossing the Channel. 6. The Norman cavalry suffer a temporary check. 7. The Battle of Hastings. 8. Death of Harold. 9. William receives the English crown.

Photos. Na

two sons of Ethelred, King of England, and Emma of Normandy, William's great-aunt, were brought up at the court of Duke William during the reign of Cnut and Hardicanute. Edward succeeded to the English throne on the collapse of the Danish rule in 1042. William visited him in 1051 and obtained from him a conditional promise of the reversion of the English crown. When Harold, Earl of Wessex, the second son of Godwin and brother-in-law to Edward, became shipwrecked on the coast of Normandy in 1064, and fell into William's hands, he was forced, as a condition of his release, to acknowledge the Duke's claim.

In defiance of the Church, which opposed the marriage on the ground of consanguinity, William married Matilda, daughter of the Count of Flanders, in 1053. The objections of the great churchman, Lanfranc, were afterwards withdrawn and Pope Nicholas II lifted the ban.

Edward the Confessor died early in 1066, leaving no heir.

Harold Godwinson immediately had himself proclaimed and crowned king. William decided to assert his claim by invasion and was encouraged to do so by Pope Alexander II who was hostile to Harold because of the danger to the connection between England and Rome which came from Stigand, Archbishop of Canterbury, nominee of the Antipope Benedict.

William prepared his invading armament with great deliberation through the spring and summer of 1066. He gathered in the estuary of the Somme about 3000 craft of all sizes, with some 50,000 to 60,000 fighting men. Of mounted knights there were 14,000. He crossed the English Channel on the evening of 28th September, and landed unopposed at Pevensey Bay the next morning. The news reached Harold on the third day, and he at once marched south from Stamford Bridge where he had fought and slain his brother Tostig and Harold Hardrada of Norway.

The battle between William and Harold was joined on 14th October, near Hastings (which see), and victory fell to the Norman. William rode to Dover and seized the castle. Then circling round London, he crossed the Thames at Wallingford and approached the city from the north-east. The Council submitted as the Church had already done, and the Conqueror was crowned on Christmas Day. The pacification of England took another four years to achieve, but may be said to have been completed with the capture of Chester in 1070. Two years later the king invaded Scotland and forced Malcolm to accept him as overlord.

His position on the English side of the

Channel being thus secure, William returned to Normandy to meet a danger which threatened from some of his turbulent subjects who during his absence had conspired against him. The rebellious barons were aided by his own son, Robert Curthose, and Philip, King of France. The insurrection was quelled, though not without difficulty.

During the last years of his reign, William caused the Domesday Book (which see) to be compiled, a survey of the land which served for the purposes of assessment of property



WILLIAM THE CONQUEROR

Photo: Newtons

for taxation. In 1086 he caused many landholders to pay homage to himself in person on Salisbury Plain in order to emphasize a particular feature of English feudalism: the principle that sub-tenants were required to render obedience not to their immediate superior but to the suzerain himself. William's policy led to greater centralization of government and contributed greatly to the early creation of a unified State.

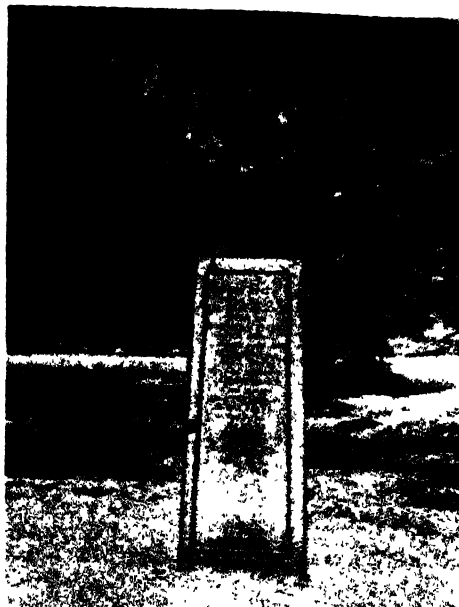
In his dealings with the Church, William owed much to the wise counsel of Lanfranc, whom he made Archbishop of Canterbury in 1070. The English Church was brought into more intimate relation with Rome. As important benefices fell vacant, they were

filled by Norman churchmen who brought with them the wider culture of the Continent. His establishment of separate Church Courts was later to cause serious difficulties. See **HENRY II OF ENGLAND**.

William met his death as a result of an accident caused by his horse stumbling while he was riding in the town of Mantes, given over to the flames as a penalty for rebellion. He was buried at Caen.

The Conqueror, although ruthless and violent and sternly inflexible, was in some respects in advance of his age. In a time of licence, his private life was unsullied. He had a strong vein of religious feeling in him. His treatment of the Jews was marked by tolerance. As an administrator he was pre-eminent. He had the wisdom to found his politics in England on conservative lines, retaining Anglo-Saxon institutions and safeguarding popular liberties against encroachment by unscrupulous barons.

WILLIAM II, RUFUS (c. 1056-1100) King of England from 1087 to 1100, he was the third son of Duke William of Normandy (later King William I of England) and Matilda of Flanders. William followed feudal tradition by leaving his patrimony, the Norman dukedom, to his eldest son Robert and his conquest, the English kingdom, to his next surviving son, William Rufus. Robert was supported by many of the barons who held lands on both sides of



THE RUFUS STONE IN THE NEW FOREST

The inscription reads: "Here stood the oak tree on which an arrow shot by Sir Walter Tyrrell at a stag glanced and struck King William the Second, surnamed Rufus, on the breast, of which he instantly died on the second day of August anno 1100."

Photo Frisk



WILLIAM RUFUS

Photo - Newtons

the Channel in challenging his brother's right. Odo of Bayeux hatched a conspiracy which, with the help of his English levies and the blessing of the Church, William had no great difficulty in suppressing. Peace was made between the brothers by the Treaty of Caen in 1091, whereby it was agreed that England and Normandy should again be united under the rule of the survivor. In 1096 Robert, anxious to obtain ready money for a Crusade, gave Normandy to William in pledge for a loan of 10,000 marks.

William's position was still none too safe. Like his father, he invaded Scotland in order to assert his suzerainty over Malcolm, and in 1095 he had to face a more formidable danger in the North, when Robert Mowbray, Earl of Northumberland, raised the standard of rebellion. The rising was caused by the tyranny and exactions of Ralph Flambard, an upstart Norman favourite of William, who was made Justiciar of England and encouraged the king in his selfish despotism. More particularly he abused feudal law by keeping vacant ecclesiastical sees and pocketing the revenues, and by imposing arbitrary fines on heirs to estates before they could

enter upon their inheritances. Even the See of Canterbury was thus kept vacant for five years after the death of Lanfranc.

Mowbray's rebellion was crushed with much severity, and William, relieved also of the pressure of his brother, Robert, in Normandy, felt himself so firmly established that he could indulge in ambitious dreams of conquest in Scotland, Wales, and France. But ill-health came, and with it contrition. In 1093, on a sick-bed, he appointed Anselm (see ANSELM) to succeed Lanfranc. Anselm was a pious and learned scholar of the Abbey of Bec who had no wish for such high preferment, especially at the hands of William. But having been prevailed upon to accept the office, Anselm stood up fearlessly for the right as he saw it. He rebuked the king for his vicious habits and for his avarice. A direct quarrel broke out over the question of the recognition of the orthodox Pope Urban II or of the Antipope Clement, who was the nominee of the Emperor. Anselm insisted on the recognition of Urban, notwithstanding the claim of Rufus that there could be no recognition without the consent of the king. In this question was involved the greater principle of the relation of the civil and the ecclesiastical authority, a principle which was to be fought over again between Henry I and Anselm, and later between Henry II and Becket. The Archbishop also protested against the king's policy of feudalizing the relations between Church and State, that is, the dealing with ecclesiastical fiefs as if they were indistinguishable from lay fiefs. William summoned Anselm to appear before his court to answer to a charge of withholding his feudal services; the Archbishop refused to appear, was condemned, and fled abroad.

In 1097 William for the last time led an expedition to Normandy to demand cession of the Vexin, the district around the town of Mantes in Maine, which had long been in dispute with the King of France. He returned to England with little accomplished, and soon after was fatally struck, probably without intent, by an arrow shot, as tradition says, from the bow of Walter Tyrrell during a hunt in the New Forest. He was buried in Winchester Cathedral.

WILLIAM III (1650-1702). King of Great Britain and Ireland. WILLIAM OF ORANGE gained the English throne as co-ruler with his wife. His life purpose was the destruction of the power of the French king, Louis XIV. He was born shortly after the death of his father, William II, whose attempt at absolute power had caused the office of Stadtholder to be abolished. The Dutch people favoured the House of Orange and he was therefore watched with suspicion by the

de Witt brothers, the leaders of the oligarchy then in power. When in 1672, Louis invaded Holland, William, whose family had gained fame in the defence of its country, was chosen as Stadtholder, and an angry mob, weary of an unpopular Republican regime, murdered John and Cornelius de Witt. By opening the dikes, he checked the French advance. For the rest of his life, he was engaged in almost continuous wars with Louis.

In 1677 he married his cousin, Mary, daughter of James, Duke of York (see MARY II of Great Britain). His wife was the eldest



WILLIAM AND MARY ACCEPTING THE CROWN
Photo. Newtons

child of England's heir and from then on wards he closely watched English politics. Realizing the strength of the opposition to James, he attempted to win the nation's support. Certain of James's enemies sent an invitation to William, the "Champion of Protestantism," and in 1688 he landed in England with an army of 14,000. As James's eldest daughter Mary, a Protestant, was William's wife, and the king's only son, a newborn baby, was to become a Catholic, it was natural for the Protestants of England to hail William, himself a grandson of Charles I, as a deliverer. James fled to France, William marched on London, and the "abdication" of James was announced.

Neither William nor Mary would agree to her accession as sole ruler, so they were accepted as joint Sovereigns. In an attempt to legalize the position the Lords and Commons met, styling themselves a Convention, and drew up a Declaration of Right, subsequently passed as the Bill of Rights in 1689. This declared the illegality of the power of the Crown to dispense with the laws, of the

Court of Ecclesiastical Commission, and of the levying of money by prerogative and the maintenance of a standing army without Parliamentary grant; it also declared for the right to petition, freedom of election and of speech, and the necessity of frequent Parliaments, and announced that no Papist or spouse of a Papist could occupy the Throne.

Great changes resulted from this "Glorious Revolution." A life-grant was made to the Crown for ordinary expenses, but other grants were made for special purposes and the appropriation of supplies by Parliament soon became the custom. Oaths of Allegiance and Supremacy were enforced on all office-holders. Sancroft, Archbishop of Canterbury, and many other clergy, could not conscientiously take them and resigned, to the great loss of the Church of England. A Toleration Act gave freedom of worship to Protestant Dissenters, who supported the Revolution, but penal laws were enacted against Catholics and Unitarians.

William found himself in an exceptionally difficult situation. He had not, as has often been claimed, been hailed by the voice of a united nation, but had profited by a wave of national excitement and the maladroitness of James. A minority of his subjects welcomed his succession; another, but probably more numerous, minority were fiercely hostile. The enormous majority, in a state of considerable stupefaction, disliked almost equally a foreign and a Catholic king.

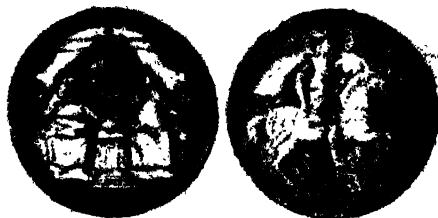
William, though superficially a king on sufferance, was able by political adroitness to maintain an assured and strong position.

Scotland. In 1688 James II had ordered south the Scots troops, which had been led by John Graham of Claverhouse, Viscount Dundee. The Duke of Gordon held Edinburgh Castle for James. William's accession had led in the Lowlands to the "Rabbling of the Clergy," riots directed against Episcopalians, and a Convention in Edinburgh had accepted the new Sovereigns. Dundee retired into the Highlands. Cameron of Lochiel joined him and other clans were brought in by varying motives—loyalty, hatred to the Whiggish Campbells, or love of fighting. General Mackay marched on Blair-Atholl. Dundee met him at Killiecrankie, where the Highland charge swept away the regulars. Dundee, however, was killed as he led the charge and the rising ended with his death (July, 1689).

Presbyterianism was restored, and a proclamation was issued that all Highland chiefs must take the Oath of Allegiance before a magistrate by 31st December, 1691. It was the unfortunate failure of Maclean, chief of the Macdonalds of Glencoe, to take

the oath by the stipulated date that led to the "Massacre of Glencoe."

Ireland. Except for Ulster, Ireland naturally remained loyal to the Catholic James, who landed at Kinsale in 1689. The northern Protestants were besieged in Derry and Enniskillen; Derry, after terrible privations, was relieved by sea and the men of Enniskillen won an engagement at Newton Butler. William landed in 1690 and defeated James at the Battle of the Boyne, James returning to France. Herbert, Lord Torrington, was badly defeated by the French off Beachy Head and they were able to send troops to Ireland. Ginkel defeated St. Ruth at Aughrim and besieged Sarsfield in Limerick; he held out with great gallantry. In 1691 the Treaty of Limerick was drawn up; by



GREAT SEAL OF WILLIAM AND MARY
Photo. Newtons

this those who had fought for James could retire to France and concessions were made to Catholics. Subsequent Parliaments broke all the clauses dealing with the civil population, and Ireland was ruthlessly exploited by the English oligarchy and their merchant allies.

The war with France continued, William, a dogged but not brilliant soldier, being defeated at Steinkirk in 1692, but Admiral Russell defeated Tourville off La Hogue. In 1693 William was beaten at Landen. Peace was made at Ryswick in 1697.

In 1701 the death of the Duke of Gloucester, only surviving child of Princess Anne, caused the Act of Settlement, by which the Crown went on failure of Anne's heirs, to Sophia of Hanover, granddaughter of James I. William died in the next year, being thrown when his horse trod on a mole-hill. The War of the Spanish Succession thus belongs to Anne, but it was William's skilful diplomacy which had allied the nations against his old enemy, France.

WILLIAM IV (1765-1837). King of Great Britain and Ireland. William Henry was the third son of George III. In 1779 he joined the *Prince George* as a midshipman and in 1780 served at Rodney's victory over the Spaniards off Cape St. Vincent. He was later stationed off America, where he first met

Nelson. A close friendship sprang up between them, and Nelson personally vouched for his ability as a sailor. At the end of the war he was sent to Prussia. In 1786 he was on the West Indian station, commanding the *Pegasus* frigate. In 1788 he was put in command of the *Andromeda*. Next year he came home, and was created Duke of Clarence.

His professional record was good but, when war with France broke out again, his

he married Princess Amelia Adelaide of Saxe-Meiningen.

Clarence emerged rather discreditably from obscurity at the trial of Queen Caroline in 1821; his enmity to her is explained by his devotion to his brothers and his respect for Mrs. Fitzherbert, whom he consistently treated as a sister-in-law. In 1827 he became Heir Presumptive on the death of the Duke of York. In the same year he was appointed Lord High Admiral. He set up a Committee on Gunnery, made himself personally known to as many officers as possible, and awarded promotions by merit. This last eccentricity outraged the politicians, for naval patronage had long been determined by influence and jobbery. Clarence resigned in 1828, "conceiving that, with the impediments thrown . . . in the way of the execution of my office, I could not have done justice either to the king or to my country."

In June, 1830, he succeeded his brother as William IV. George had long lived in a sluggish seclusion and William amazed everyone by his friendliness, his energy, and the simplicity of his life. He became immediately popular. He won high praise from Wellington for his reasonableness.

1830 was a troubled year in Belgium and in France, where the Dutch garrisons and Charles X respectively were driven out. In England there were riots and machine-smashing among the rural poor. In 1831 Lord John Russell introduced a Reform Bill (see REFORM ACTS). It had already been discussed with William. The Bill passed its second reading by a majority of one, but the Government soon suffered defeat and William, although fearing the unsettling effects of an election, dissolved Parliament. Amid much mob violence the Whigs gained a large majority, and the Bill passed the Commons, but was thrown out by the Lords. Furious resentment was roused in the country and there were many riots.

The amended Bill passed the Commons early in 1832, but it was obvious that it would be rejected by the Upper House. William tried to persuade both Whig and Tory to accept some compromise for the good of the country, but the faction spirit was strong in both parties. In the end William was forced to promise Grey that he would, if necessary, create sufficient peerages to ensure the passage of the bill. The promise was sufficient and the bill passed.

In 1833 came various important laws. Slavery was abolished throughout the Empire, the first Education Grant was made. Lord Ashley's (see SHAFTESBURY) Factory Act limited the working hours of children and appointed inspectors to see that it was



WILLIAM IV
(National Portrait Gallery)

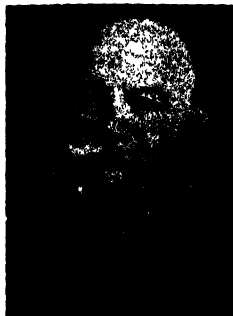
father would not give him a ship or even let him serve, as he offered, as a volunteer. He was always in debt, apparently having no head for figures. He certainly had a head for wine, in the tradition of the day, but when he was not led by his brothers into an orgy of drink or gambling he seems to have naturally preferred a temperate, open-air existence. He was eccentric and boisterously Rabelaisian in speech.

He settled down to "twenty years of blameless irregularity" with an actress, Mrs. Jordan, the Royal Marriage Act making official marriage impossible. He still kept in touch with his two leading interests, the Navy and the theatre. In 1811 he separated from Mrs. Jordan, probably under the influence of the Queen and the Regent. In 1817

obeyed. William's health was failing, and he disliked the proposed Regent, the Duchess of Kent. He was delighted when his niece Victoria, of whom he was fond, came of age.

WILLIAM (in German, **WILHELM**). The name of two German emperors.

William I (1807-1888). The first emperor of modern Germany was a sovereign of unusual force of character. The second son



WILLIAM I OF GERMANY
Photo U. & U.

of Frederick William III, king of Prussia, he received military training from his earliest years, and in 1814-15 fought as a captain against Napoleon. In the revolution of 1848, he achieved unpopularity by frank opposition to constitutional reform. In 1861 he ascended the throne as King of Prussia. He chose his advisers

with sagacity, and attained popularity by the success of Germany in the wars with Denmark (1864), with Austria (1866), and with France (1870). William was proclaimed German Emperor at Versailles, near Paris, in 1871.

William II [**FRIEDRICH WILHELM VICTOR**] (born 1859). King of Prussia and Emperor of Germany until 10th November, 1918, when he abandoned the throne.

William II was the eldest son of Prince Frederick William of Prussia and Princess Victoria of England. He ascended the throne, 15th June, 1888, at the age of 29.

The young emperor had been influenced, in his early years, rather by the victories of Prussian arms against Austria and France than by the liberalism of his father and the traditional views of his English mother.

Bismarck was still Chancellor when William II was crowned, but it was not long before they disagreed and the "Iron Chancellor" was dismissed in 1890. From that time to November, 1918, seven Chancellors held office under the imperious and restless Kaiser; they were Von Caprivi, 1890-94; Hohenlohe, 1894-1900; Von Bulow, 1900-09; Bethmann-Hollweg, 1909 to July, 1917; Michaelis, from July to November, 1917; Von Hertling; and Prince Max von Baden.

William must be credited for much of the remarkable development and progress of the German Empire during his reign. Between 1888 and 1914, the country (largely agricultural when he succeeded to the throne) was transformed. He encouraged manufactures,

trade, and commerce, and Germany became primarily an industrial country.

For the development of Germany as a Great Power and for commercial advantages, William adopted a colonial policy that added large regions of South-west and East Africa to the empire, and also gained a foothold in China and the Pacific Islands, with advantageous points for coaling and supply stations.

Colonies must be guarded and their coasts patrolled, so the German navy was largely increased under the Kaiser. Meanwhile, the German army was being brought to an unexampled state of efficiency.

During the World War, William followed closely the fortunes of his armies in the field. In the last two years of the war, much distress prevailed among the people of Germany, due to the stringent blockade maintained by the Allied fleets. Under these conditions, the Socialist party grew strong, and when the people finally awoke to the fact that their army, supposed to be invincible, was being slowly but surely defeated, revolution followed in Germany, and the republic was proclaimed with the downfall of the Kaiser.

William II was a sovereign of unusual versatility, and of a decidedly contradictory nature. Avowing himself a staunch advocate of European peace, he "rattled the sabre" more than once during his reign, and appeared to enter into the war with avidity. He was a writer of some ability and composed verses; a good speaker, and delivered sermons; he was also an able painter. He was at times liable to dramatic and indiscreet announcements.

At the castle of Doorn, Holland, the former Kaiser lives in comfortable exile. He has written a book which is in the nature of an autobiography. The Empress Augusta Victoria died at Doorn on 11th April, 1921, and he married, late in 1922, the widowed Princess Hermine of Schönaich-Carolath.

WILLIAM I (**THE SILENT**), **PRINCE OF ORANGE** (1533-1584). The champion of Dutch independence against Spain, he was born in the province of Nassau of a Catholic family. He won early renown as a military leader, and before he was of full age he was



WILLIAM II OF GERMANY
Photo U. & U.

entrusted by the Emperor, Charles V, with the command of the imperial forces in the Netherlands and became Stadtholder. Though he had been brought up in religious orthodoxy, he had few religious convictions, and when Philip II of Spain sent Alva into the Netherlands to extirpate Protestant heresy in 1567, William joined the Lutheran and later the Calvinist church and raised the standard of freedom and independence. His by-name "the Silent" is said to have been given to him because of his total concealment of his real feelings when first informed of Philip's designs.

To check the advance of Alva's troops, the Dutch cut the dikes and flooded a great part of their country. In their glorious resistance they were joined ultimately by the Protestants of Germany, and the war continued for sixteen years before William, now declared an outlaw, fell a victim to the bullet of a hired assassin in 1584. His work was but half finished, but the foundations of the new State had been well and truly laid and for the next century-and-a-half it was one of the strongest powers in the world.

The defence of the Dutch liberties and the establishment of the Dutch republic may be regarded as the first successful national uprising against imperialism in modern history. William the Silent was a man of unblemished integrity, of gentle and unselfish disposition and a true father to his people. He lived at Delft in homely simplicity, his private life being a model of Dutch domesticity. His work set an ineradicable mark upon the character of his nation.

WILLIAM II, PRINCE OF ORANGE (1626-1650). The grandson of William the Silent. He succeeded to the



WILLIAM OF ORANGE
Photo: Brown Bros.

Stadtholdership of Holland in 1647 after that office had been held in turn by his two uncles, Philip William (1584-1618) and Maurice (1618-25), and by his father Frederick Henry (1625-47). He had married in 1641, Mary Stuart, Princess Royal of England, daughter of Charles I.

William II was, like his grandfather, a man of quite outstanding qualities, and to

his political ability and personal charm he added a large spice of ambition. During his brief reign of three years, he was engaged

in a great struggle with the provinces which constituted the United Netherlands. The conflict was mainly on the question of federation, with that of a counter-attack on Spain as a side-issue. William II would gladly have taken up the offensive against Spain, and have used his authority to consolidate his territory into a unified State. To this policy the provinces were opposed. Led by the burghers of Amsterdam, they preferred decentralization to federalism, and feared that a further outbreak of war would damage trade. This city had rapidly become the emporium of the world, with a highly developed banking and exchange system. Sea communications were vital for her prosperity, and the wealthy merchants of Amsterdam thought more about their mercantile interests than about the purely political ends which the Stadtholder had in mind.

William was finally driven to assert his power by the use of force. He caused six of his opponents to be seized and imprisoned, and ordered a march on Amsterdam. After a show of resistance, the city yielded to this threat and, William's authority being restored, he was now free to pursue his ambitious scheme for the seizure of the Spanish provinces. But death from small-pox suddenly cut him short in his full career.

WILLINGDON, VISCOUNT. See DOMINIONS, VOLUME (India)

WILLOW. The common name of a genus, widely distributed, of trees and shrubs. It



GIANT WILLOW

Photo: Visual Education Service

is on the banks of streams that willows make their best growth, for they are water-loving plants. The wood is extremely tough and its pliancy and the flexibility of the branches and twigs are qualities utilized in many ways.

The flowers of willows (usually staminate and pistillate on different trees) are borne in drooping catkins. The catkins appear

before the leaves, and before the foliage is fully developed, the podlike fruits, or capsules, split open and release the small, downy seeds. On their white, silky hairs they are carried far and wide by the winds. Willows also reproduce through the rooting of falling twigs and branches.

The tall-growing *black willow* of Eastern North America has very dark bark and characteristic leaves with elongated tips.



WILLOW CATKINS

Photo. Visual Education Service

The *white willow* of Europe is a tall species. The under sides of its leaves have a whitish appearance, whence its name. Other familiar species are the *weeping willow*, whose drooping branches are often used by landscape gardeners for decorative effects, the shrub-like *pussy willow* with the furry catkins, and the *black willow* of North America.

Economic Value. Few trees have more varied uses than the willow. Because of its rapid growth, it is used as a hedge and shade tree. The wood is white, soft, and light, and is more durable in water than is any other timber. It is employed extensively for cabinet-work, baseball and cricket bats, hoe handles, and many small articles. The bark contains a large amount of tannin, and is also the source of the medicinal extract salicin.

However, the most important industrial use of the willow is in the making of wicker-work and baskets from the young shoots, or osiers.

Scientific Names. The willows belong to the family *Salicaceae*. The black willow is *Salix nigra*; the white, *S. alba*; the pussy willow, *S. discolor*; the weeping willow, *S. babylonica*.

WILNO. Local official name for VILNA. See POLAND.

WILSON, THOMAS WOODROW (1856-1924). President of the United States from

1912 to 1920. He was born at Staunton in Virginia of a stock which came originally from Scotland and Ulster. His father was a minister of the Presbyterian Church. Educated at Princeton University and the University of Virginia, he at first took up the practice of law, and later became Professor of History at Bryn Mawr College and subsequently Professor of Jurisprudence and Political Economy at Princeton. In 1902, Wilson became President of Princeton, where in a democratic spirit he instituted many important changes. In 1910 he was elected Governor of New Jersey and used his powers in promoting anti-trust and social reform legislation. In his attacks on the "bosses" he was supported by W. J. Bryan, who secured his nomination by the Democratic Party for the Presidency of U.S.A. Wilson was elected in 1912 by a large majority over Taft and Roosevelt. Four years later he was elected to the Presidency for a second time.

As President, Wilson carried through important financial reforms, including a downward tariff revision, and the establishment of a Federal Reserve Bank. He continued his



WOODROW WILSON

Photo: U. S. U.

slaught on the Trusts and legalized Trade Unionism. Externally, the Civil War in Mexico caused him anxiety and he laid down the famous "Wilson Doctrine," which declared it to be the set policy of his administration to refuse to recognize any authority in the Central American States that was not based on constitutional principles. He deprecated the intervention of big financial interests in the internal affairs of the smaller American republics.

On the outbreak of the World War (1914), Wilson declared that the policy of U.S.A. was neutrality. Trouble arose with Great Britain when American vessels making for neutral ports were detained and searched for contraband. But America was shocked by the inhumane activities of the German submarines and especially after the sinking of the *Lusitania*, opinion veered round in favour of intervention on the side of the Allies.

Wilson, after his re-election, made a last attempt at mediation by negotiation, but in April, 1917, declared war on the Central

Powers. "The world," he said, "must be made safe for democracy."

In November, 1918, President Wilson took a leading part in settling the terms of the Armistice, and subsequently of the Peace of Versailles. He laid down the "Fourteen Points" or principles for the making and the safeguarding of a lasting peace among the nations. These he first expounded in a speech addressed to Congress and to them the Central Powers pinned their hopes of an honourable peace. In addition to the Fourteen Points, he helped to draft the Covenant of the League of Nations, and held that this and the Treaty were interdependent. But American opinion was largely hostile to that article of the Covenant which seemed to involve U.S.A. in European diplomacy and war. The President failed to secure ratification, and the Senate refused to join the League. A breakdown in his health followed, and at the Presidential election of 1920, a Republican, Harding, triumphed over J. M. Cox, the Democratic candidate. Wilson retired into private life and died four years later. His work for peace was recognized by the award of the Nobel prize in 1920.

President Wilson will live in history as a great statesman-idealist. He based all his work on sound democratic principles, which he served steadfastly and fearlessly. He had none of the arts of the demagogue, and his austerity of character kept him a little aloof. But he was a great humanitarian with a profound belief in the perfectibility of man.

WILTSHIRE. A south-central county of England, bounded on the north by Gloucestershire, on the south by Hampshire and Dorset, on the east by Berkshire and Hampshire, and on the west by Gloucestershire and Somersetshire, with an area of 860,829 acres, and a population in 1931 of 303,258.

Physical Features. The dominant physical feature of the county comprises the two chalk plateaux of Salisbury Plain and the Marlborough Downs, forming the centre of the chalk hills of England from which radiate the Berkshire Downs and the North and South Downs. In the south Salisbury Plain rises gradually from the valleys of the Nadder and Wylye and presents a steep escarpment to the north overlooking the Vale of Pewsey. The average height is about 400 ft. above sea level, but along the northern edge there are several points which exceed 700 ft. Notable among these are the Long Knoll, 950 ft., Pewsey Hill, 800 ft., Cley Hill, 900 ft., and Westbury Hill, 750 ft. The scenery of the Plain is uniform and is distinguished by the vast grassy Downs which were formerly grazed over by numerous flocks of sheep, the absence of which to-day has in several dis-

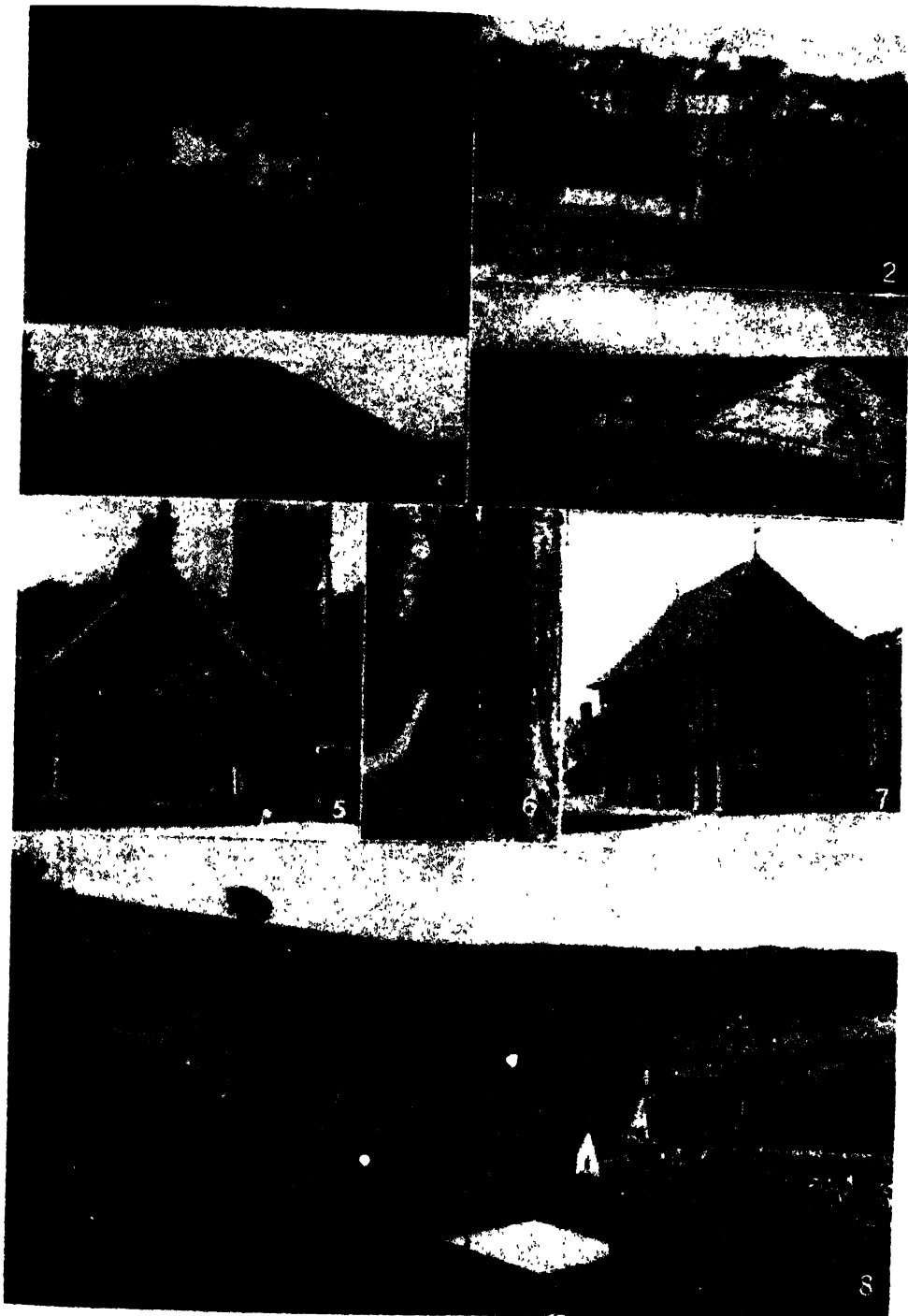
tricts resulted in the typical short grass of the Downs becoming long and rank. The valleys, in which are situated all the villages of the Plain, have been converted into fertile land.

The Marlborough Downs by contrast rise steeply on the south from the Vale of Pewsey and slope more gradually northward towards the watershed of the Thames. The Downs themselves bear a close resemblance to those of Salisbury Plain, though the fertile valleys are more numerous. The highest point is Tan Hill, 960 ft., but the general elevation exceeds 500 ft. In the south-east corner of the plateau between Marlborough and Savernake, Savernake Forest is a belt of rich woodland nearly 20 sq. miles in extent, where the oak, beech and ash are prolific, and the well-known "walks" are some of the most beautiful forest drives in England. In the extreme south of the county another ridge of chalk Downs divides it from Dorset and includes Cranborne Chase, for centuries a famous hunting country. This ridge also presents a steep face to the north and rises to a height of over 700 ft.

The remainder of the county consists of four river valleys and a broad belt of lowlands in the north-west. The Nadder rises near the south-west corner and flows generally eastward through Tisbury and Wilton to Salisbury, where it joins the Avon. This latter rises to the north of Salisbury Plain and flows south through Upavon and Bulford to Salisbury, passing out of the county near Downton. Its course is marked by scenery of great distinction, especially where it cuts a narrow, well-defined gap through Salisbury Plain. The Wylye is a tributary of the Nadder, flowing south-east from the Warmunster district to Wylye and Wilton. Like the Avon, the greater part of its course is through a combe in the chalk Downs. In the south-west the Bristol Avon, flowing south from Malmesbury to Bradford, waters a broad valley of pasture land diversified by long rows of elm trees which give this district a characteristic beauty.

All the country to the north of the Marlborough Downs comes within the watershed of the Thames, which flows through Cricklade to Lechlade, forming for part of its course the northern boundary of the county.

Climate. The temperature and rainfall are generally rather low compared with the neighbouring counties, due in the case of temperature to the elevation of the chalk country, and in the case of rainfall to the absence of any extensive woodlands on the high ground. The mean annual temperature approximates to 50°, but is considerably higher in the north-west than in the central or southern districts. The town of Marlborough is one of the three coldest towns



WILTSHIRE

1. Welsford village. 2. Malmesbury. 3. Silbury Hill. 4. Salisbury Plain near Bratlin. 5. Castle Combe. 6. Path in Savernake Forest. 7. Town Hall at Wootton Bassett. 8. Bishopstone, near Swindon.

Photos: Taylor; George Long

in southern England during the winter months. The mean annual rainfall is 30 in., being highest in the south and exceeding 32 in. at Salisbury, and lowest in the northern towns, where it is approximately 27 in.

History. Archaeological evidence suggests that in prehistoric times Wiltshire was an important centre of population (see *Antiquities*). It was intensively occupied also by the Romans, who had stations at Mildenhall and Old Sarum. In the sixth century it was a part of the Kingdom of the West Saxons, when the town of Wilton, from which the county takes its name, was founded in the Vale of Wylfe by the earliest Saxon colonizers. Danish invasions followed and Wilton became an important Danish stronghold. It may have been within the county at Edington that Alfred won his notable victory in the Battle of Ethandune over the Norse invaders.

The Norman Conquest was effected without incident. William the Conqueror held a court at Old Sarum in 1086. In 1164 also a court was held in the same district when the Constitutions of Clarendon were enacted.

Wiltshire witnessed several battles during the Civil Wars, including the defeat of General Waller on Roundway Down in 1643. Devizes held out for the King until near the end of the War but was finally besieged and captured. During succeeding centuries the county's agricultural wealth increased and immediately before the Industrial Revolution there was a large and flourishing rural population, which has decreased in recent years, although the Army occupation of a part of Salisbury Plain has brought a new prosperity to that district. The county is

at present represented by five members in Parliament, returned respectively by the Chippenham, Devizes, Salisbury, Swindon and Westbury districts.

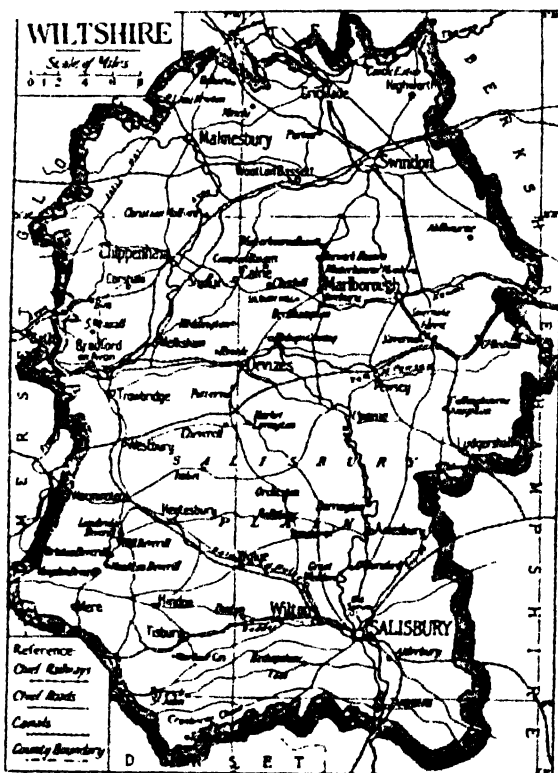
Antiquities. Wiltshire is richer in prehistoric antiquities than any English county except Kent. The two most important monuments are Stonehenge and Avebury, the former being better preserved, but the latter larger, and one of the most important prehistoric monuments in Europe.

Stonehenge is an elaborate stone circle which may most probably be ascribed to the end of the Neolithic Period, about 1800 B.C. It has been inferred that it was erected as a temple to the Sun from the fact that on the longest day the sun appears to rise behind an external stone to an observer in the centre of the circle. It is a surprising fact that a number of the stones are not of local origin but were apparently brought from the Prescelley range of hills in Pembrokeshire. Stonehenge is also significant as showing the

first use of a toggle joint in erecting the great trilithons.

Avebury also was originally a stone circle, although little but the ditch and bank which surrounded it have survived and now contain within them the modern village. The stone avenue leading away from the circle has recently been excavated and re-erected.

Lesser stone circles belonging to the Neolithic Age occur at Winterbourne Bassett and Hackpen Hill. Long Barrows belonging to the Neolithic Age and Round Barrows belonging to the later Bronze Age are numerous. The two most notable of the Long Barrows are that at West Kennet, which is over 330 ft. long, and the Devil's



Den near Fyfield, which is the cist of a long barrow from which the earth has been washed or ploughed away as at Wayland's Smithy in Berkshire. There are several hundreds of round barrows on Salisbury Plain alone.

Among prehistoric earthworks Silbury Hill, the largest artificial mound in Europe, stands pre-eminent. Its origin is unknown, but it is generally ascribed to the Neolithic or Bronze Age. Another theory is that it is a Roman burial mound. Old Sarum and the castle mound at Marlborough may also be of prehistoric origin. Iron Age or earlier hill-top fortresses occur on Windmill Hill, near Avebury, Yarnbury Hill, Bratton Castle, Sidbury Hill, and many others. The Ridgeway is an early track, contemporaneous with the Icknield Way, which traverses the Marlborough Downs and is continued over the Berkshire Downs and the Chilterns.

Lynchets, or early cultivation terraces, have been noted on the Downs near Bishopstone and elsewhere. The Wansdyke is probably a boundary line between two early Saxon kingdoms. The Saxon period is also recalled by the church of St. Lawrence at Bradford-on-Avon, which is one of the most complete Saxon churches in the country. Medieval castles and monastic ruins are few. There are fragments of the castles of Devizes and Marlborough and earthworks at Ludgershall, whilst the castle which gives Castle Coombe its name has practically disappeared. Portions of the Abbey church at Malmesbury can be seen, but the ruins of Lacock are the most picturesque in the county and include part of the cloisters and chapter house.

Industries and Manufactures. Agriculture remains the principal industry. Sheep and cattle are both raised in large numbers, particularly in the north-west where dairy-farming and its attendant light industries occupy the greater part of the population. Pigs are also raised and cured locally, Wiltshire bacon having a national reputation. The curing industry is centred principally in Devizes and Chippenham. Butter is produced in the Avon valley. Horse breeding also is a flourishing industry and there are many important stables on the Marlborough Downs and at Beckhampton.

Cereals and root crops have greatly diminished during the last fifty years. Oats, wheat and barley together occupy less than 100,000 acres. Manufacturing industries are of secondary importance and chiefly confined to small centres. Thus, Wilton has long been famous for its carpets and Trowbridge is the sole surviving town to retain the manufacture of cloth, which in the later Middle Ages was carried on in a large number of the western and southern towns.

Swindon is an important manufacturing town to which added prosperity has been brought by the engineering works of the Great Western Railway.

Principal Towns. The county town is Salisbury (which see). The following also will be found in their alphabetical positions: Marlborough, Swindon, and Trowbridge.

Calne. Area 356 acres, population (1931) 3463. A municipal borough in the north-west of the county, formerly a large centre of the cloth-making industry and at present principally employed in the production of Wiltshire bacon. There are also engineering works engaged in the manufacture of agricultural machinery.

Chippenham. Area 1197 acres, population (1931) 8493. A municipal borough and market town with charters which date from the Saxon days, once a residence of King Alfred. Engineering works and a bacon-curing factory give employment to most of the population.

Devizes. A municipal borough, area 906 acres, population (1931) 6058. The principal market town of the fertile country of the north-west.

WIMBLEDON. A Municipal Borough of Surrey with an area of 3221 acres and a population in 1931 of 59,520. Since Wimbledon received its Charter of Incorporation in 1905 it has grown very rapidly, and is to-day one of the most populous of the farther suburbs of London. It is largely residential. Wimbledon Common is a partly wooded expanse of nearly a thousand acres which was preserved as an open space by Parliament in 1871. It is of great archaeological interest, for Neolithic implements have been discovered here in large numbers, and hut circles were recorded until recent years. Caesar's Camp is a large circular earthwork which is probably of Iron Age construction, though as its popular name suggests it may have been occupied by the Romans.

WINCHESTER. A city, municipal borough and market town of the county of Southampton with a population of 23,969 in 1931. Its early history was unusually troubled, but since the Middle Ages has been entirely peaceful. Modern Winchester has not shared in the general industrializations of the country as a whole, but remains a cathedral city purely and simply.

The site was occupied by a Celtic tribe who were driven out by the Romans in the first century. Thus was founded the town of Venta Belgarum. Owing to continuous occupation, traces of the Roman period are slight, but as the meeting-place of five Roman roads the town must have been a place of importance. In 519 it became the



1. Statue to King Alfred. 2. St. Cross Hospital. The West Gate.

WINCHESTER

Photos Frick

capital of the Kingdom of Wessex, whilst in the seventh century the first church of SS. Peter and Paul was founded—the forerunner of the later cathedral. The bishopric was transferred from Dorchester in 674, among the early holders of the Chair being St. Stephen. Winchester became the capital of the kingdom of Alfred and later of Cnut who resided here with his queen, and was buried in the cathedral. Even after the Norman Conquest Winchester continued joint capital of England with London. The last parliament to be held in the town was in 1283.

The Cathedral represents every style of architecture from the eleventh to the sixteenth centuries and is 556 ft. long and 217 ft. broad at the transepts. Norman work can be seen in the crypt and nave, the latter being otherwise the most splendid example of Gothic architecture in the country. Three of the gates of the medieval town were

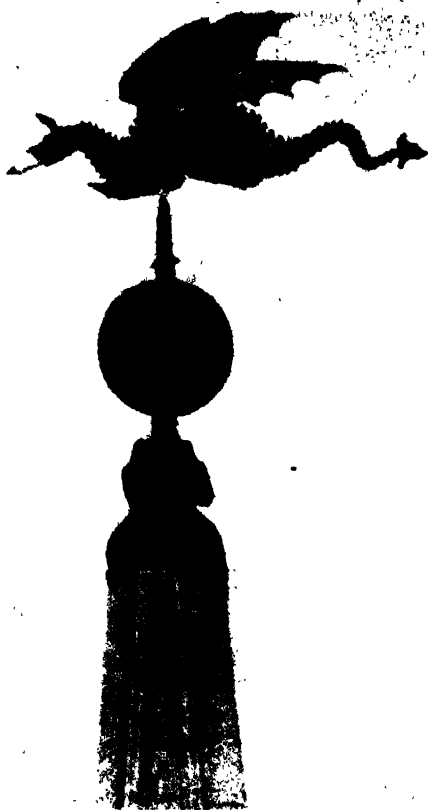
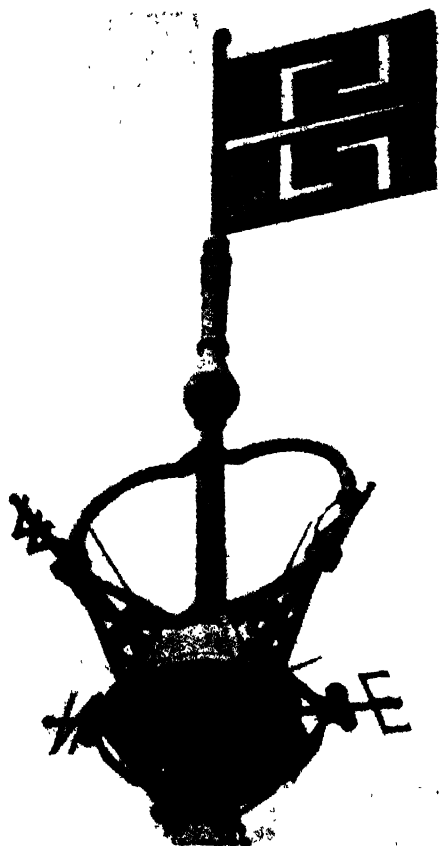
destroyed in the eighteenth century, the only one remaining being the West Gate. There are also ruins of the twelfth-century castle of Henry de Blois. Winchester College, now an important public school, was one of the most important foundations of the Middle Ages and was established in 1382 by William of Wykeham, later incorporating the establishments of the Orders of Friars. Several ancient churches, apart from the cathedral, have been preserved in the city. Among these is the Church of John the Baptist, with its noble late arcades; and the Church of St. Mary with its Norman doorway in the tower. The Great Hall—later the County Hall—dates from the thirteenth century and was originally part of the castle. It contains the traditional King Arthur's Round Table which is, however, no older than the hall itself. One other building of great interest is the

Hospital of St. Cross which was founded in 1133, where the medieval alms of bread and beer are still given. The Church of St. Cross is possibly the most perfect Norman church in England.

WIND. Defined in simplest terms, wind is air in motion parallel to the earth's surface. The cause of wind is readily understood by a study of the general circulation of the atmosphere. The region along the equator is the most intensely heated of any part of the earth's surface. The atmosphere over this belt is consequently warmer and lighter than that on either side, and is forced upward by the higher pressure of the heavier air. Over the equatorial regions, then, there is constantly an ascending current, and since the current is not perceptible, sailors call this region the *belt of equatorial calms*. As the air rises, there is a constant surface current from the tropical latitudes towards

the equator. Were it not for the rotation of the earth, these currents would be due north-and-south currents; but in flowing from the Polar towards the equatorial regions, the atmosphere is constantly coming in contact with portions of the earth whose velocity of rotation is greater than that of the region from which they come. Since the air is unable to acquire this velocity as rapidly as the solid earth, these currents lag behind, as it were. In the northern hemisphere, they blow from the north-east, and in the southern from the south-east. These are the Trade winds.

The ascending current over the equator soon reaches an altitude where the surrounding atmosphere is of equal density, and it becomes a horizontal current, flowing toward the poles. The farther this current flows, the cooler it becomes, until, in the temperate latitudes, it reaches the same



WELL-KNOWN LONDON WEATHERCOCKS

Left: The old key vane on St. Peter's Church in Cornhill. *Right:* The dragon vane at St. Mary-le-Bow Church in Cheapside.

Photos: U. & U.



THE GALLION WEATHERCOCK ON THE
INCORPORATED ACCOUNTANTS' BUILDING
IN LONDON

Photo: U. & U.

temperature and density as the surface layers of atmosphere, and gradually mingles with them. Since this mingling of currents of equal density equalizes the atmospheric pressure over these regions, there may be large areas on the ocean where for days together there is no wind. These regions are known as the *calms of Cancer* and the *calms of Capricorn*. Outside these belts of calms, the currents flowing from the equator become surface currents, forming westerly winds. Here again the deflection from a north-and-south course is caused by the rotation of the earth. Currents flowing toward the Polar regions are flowing from regions of higher to those of lower velocity of rotation, and they run ahead or blow toward the east. From polar regions heavy cold air flows equatorwards and, deflected by the earth's rotation, blows as north-east and south-east winds respectively in the northern and southern hemispheres.

Lofty mountains, the shape of the con-

tinents, and minor local causes affect the surface currents, so that a detailed study of winds is decidedly complex.

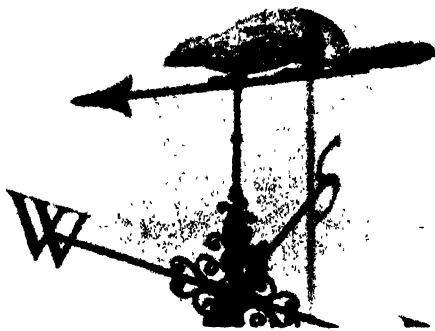
Beaufort Wind Scale. In describing the force of wind, sailors use a scale drawn up in 1805 by Rear-Admiral Beaufort. The following table gives the numbers of the Beaufort scale, the designation of winds, and their approximate velocity in miles per hour—

0	Calm	3	titles or less
1	Light air	8	" "
2	Light breeze	13	" "
3	Gentle breeze	18	" "
4	Moderate breeze	23	" "
5	Fresh breeze	28	" "
6	Strong breeze	34	" "
7	Moderate gale	40	" "
8	Fresh gale	48	" "
9	Strong gale	56	" "
10	Whole gale	65	" "
11	Storm	75	" "
12	Hurricane	90	" "

Effects of Wind. A cold wind blowing into warm regions has its capacity for moisture increased. Therefore, such winds usually assure clear skies and bright days. On the contrary, a warm wind blowing into a cooler region has its capacity for moisture decreased. A portion of its water vapour is condensed, forming clouds, and if the condensation is carried to the point of saturation, rain falls. The rainfall of a locality is, therefore, largely determined by the prevailing winds.

WINDHOEK, vint' hook. Capital of South-west Africa (which see).

WINDLASS. A machine for lifting weights by the application of a relatively small power. The common windlass is a wooden drum on which a rope or chain is wound by handspikes or a winch attached to the end. This type is of frequent application in drawing water from a well. The lifting power of a windlass may be increased by connecting



THE BEAVER WEATHERCOCK ON THE HUDSON'S BAY
COMPANY'S BUILDING IN BISHOPS GATE, LONDON

It is pivoted on diamonds

Photo: U. & U.

the drum and the winch by means of cog wheels, the larger wheel being on the drum.

WINDMILL. A device which utilizes the force of wind for carrying on various mechanical operations. The mill consists essentially



OLD WINDMILLS IN EAST ANGLIA

Photo: Fox

of a wheel formed of a number of inclined slats of wood or metal, which rotates on a horizontal axis. The slats are so arranged that the wind strikes them on the slant as it blows between them, thus forcing them along and making the wheel revolve. A vane is attached to the opposite side of the frame, as a result of which the wheel always faces the wind. The structure is mounted on a conical or pyramidal tower 20 ft. or more in height, to get the full force of the wind. An early type of windmill, now rapidly disappearing from the countryside, was constructed with four radial arms, after the style of the type still largely used in the Netherlands. When the velocity of the wind is 20 miles an hour, steel wheels of 8 ft. to 10 ft. diameter will develop 0.53 and 1.03 horse-power respectively.

WINDPIPE. See TRACHEA.

WINDSOR, HOUSE AND FAMILY OF. The name of the Royal Family of England, adopted by proclamation of 17th July, 1917, to replace the family name Saxe-Coburg-Gotha, for during the war the German name naturally came into disfavour. Windsor has been a royal residence from the time of Edward the Confessor. The first sovereign

of the House was George V. On his death he was succeeded by his son, Edward VIII. In the following November, King Edward announced his intention of marrying an American woman, Mrs. Simpson, as soon as she had obtained her pending divorce. Mr. Baldwin, the Premier, voiced the unwillingness of the Empire to accept as queen a woman whose marriages with two men had resulted in divorces. Morganatic marriage is not known to the Constitution, and it was clear that the nations of the Empire were unwilling to introduce it by special legislation. The King, deciding not to forego the marriage, abdicated on 10th December, 1936, to the deep regret of his peoples, and the throne passed to his brother, the Duke of York. This did not create a constitutional crisis, for the powers and prerogatives of the Crown were in no way affected. Admirable dignity and restraint were shown by all political parties, nor was there any attempt to make political capital out of the situation. Edward, created Duke of Windsor by his brother, retired to the Continent.

George VI (born 1895). Albert Frederick Arthur George, second son of King George V, adopted, like his father, a naval career, passing through Osborne and Dartmouth. He served in the Battle of Jutland in 1916, being then a sub-lieutenant, and was mentioned in despatches. He was subsequently transferred to the naval branch of the Royal Air Force. In 1919 he was entered with his younger brother, Prince Henry, at Trinity



HIS MAJESTY KING GEORGE VI

Photo: Topical

College, Cambridge, and pursued a year's course of studies. In 1920 he was created Duke of York, Earl of Inverness and Baron Killarney. He married in 1923 Lady Elizabeth Bowes-Lyon, daughter of the Earl of



HER MAJESTY QUEEN ELIZABETH
Photo: Fox

Strathmore and Kinghorne; her mother is a sister of the Duke of Portland. This ancient Scottish house is descended from

Patrick Lyon, 1st Lord Glamis, great-grandson of Robert II, King of Scotland.

King George VI has always taken an especial interest in social problems and became President of the Society for Industrial Welfare. An original and remarkably successful experiment for which he was responsible has been the summer camps composed of working class and public school boys; in every year since their inception he has visited the camps for a few days. He was President of the British Empire Exhibition in 1925, and in 1927 he opened at Canberra the new Parliament buildings of Australia.

He is an all-round sportsman, a fine shot and a good lawn-tennis player; he is the only member of the royal House to have played in the Wimbledon Championships.

Queen Elizabeth's tact and sympathy have won her a wide popularity, which the happy domestic life of the royal couple has steadily strengthened. They have two children, Princess Elizabeth (born 1926) and Princess Margaret Rose (born 1930).

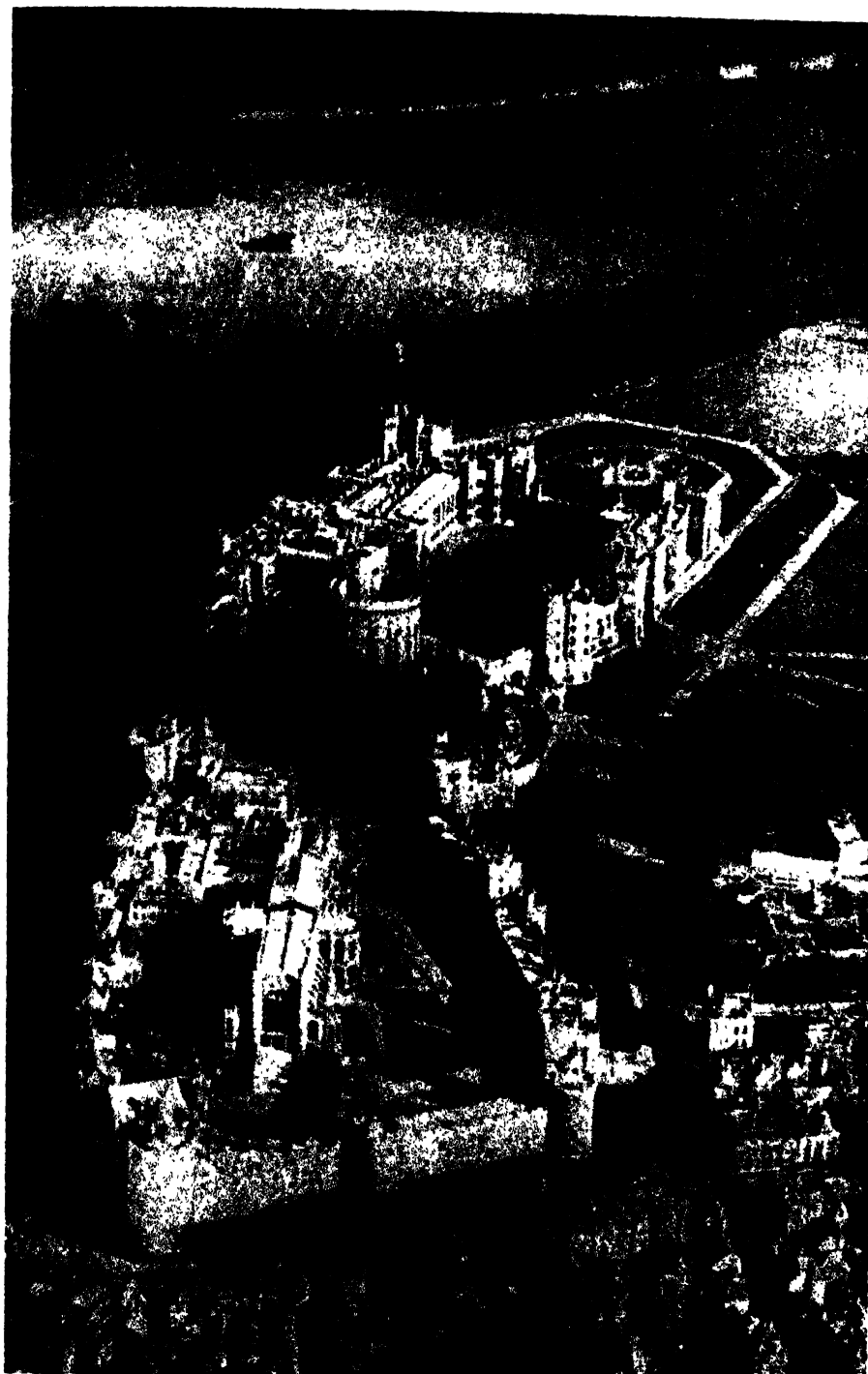
WINDSOR CASTLE. See NEW WINDSOR. **WINDWARD ISLANDS.** A British colony in the West Indies, consisting of St. Lucia, St. Vincent, and Grenada, with the smaller islands of the Grenadine chain. The islands are united under a governor, who resides at St. George's, Grenada. The Windward



A ROYAL FAMILY GROUP

The photograph was taken at Osborne House, near Cowes, Isle of Wight; in it are: Princess Margaret of Connaught, the Duke and Duchess of York (later George V and Queen Mary), Prince Albert of York, Princess Arlbert of Anhalt, Princess Victoria of York, Prince Edward of York, Prince Leopold of Battenberg, Prince Alexander of Battenberg, Queen Victoria, Prince Arthur of Connaught, Queen of Spain, Duchess of Connaught, Princess Ena of Battenberg, Princess Victoria of Schleswig-Holstein, Princess Patricia of Connaught and Prince Maurice of Battenberg.

Photo: Topical



WINDSOR CASTLE
Photo: Central

Islands derive their name from their position, being more exposed to the trade winds than are neighbouring islands.

St. Lucia, which is the largest, is 238 sq. miles in area, and had a population, in 1934, of 63,804; St. Vincent, next in size, has an area of about 150 sq. miles, and a population of 53,622; Grenada, including the Grenadines, is 133 sq. miles in area, and had a population of 82,624 in 1933. The soil and climate are favourable for agriculture, and many tropical products are raised. Sugar, cotton, arrowroot, copra, cocoa, and spices are the principal crops. The finest sea-island cotton of the British Empire is raised on the island of St. Vincent.

WINE. The juice of the grape which has been fermented. The term is also used for the fermented juice of other fruits. Grape juice contains grape sugar already formed, and, like the juice of the apple, the gooseberry, and many other fruits, it undergoes fermentation quite readily. The most valuable wines are still produced exclusively in Europe, particularly in France, Spain, and Italy, although the industry established in Australia and California, U.S.A., is a notable innovation.

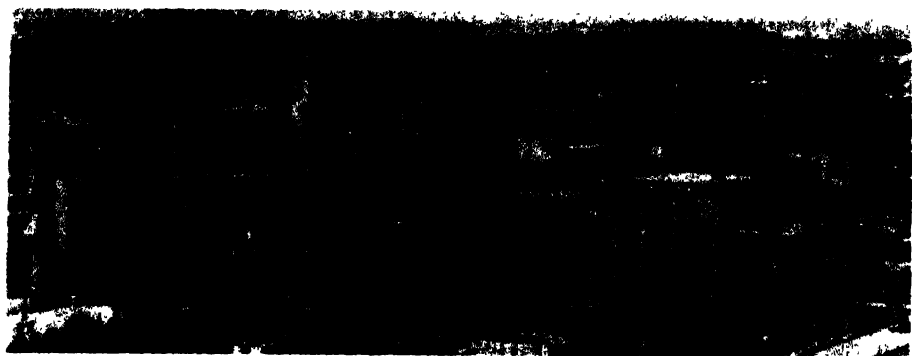
In the manufacture of wine, the juice of the grape is removed in a crushing machine, having two cylinders so far apart that they do not crush the seeds. The *must*, or juice, is fermented in vats of oak, having a capacity of from twenty-five to one hundred barrels. The first must that flows from the crushed fruit makes the choicest wines, and it is drawn off and treated separately from the later runs. When the fermentation has reached the stage desired for a particular sort of wine, the juice is run off into reservoirs called *tuns*, where it remains until matured. It is during the second stage that the chemical changes take place which produce the *bouquet*, or flavour and aroma of the wine.

Dry wines are produced by allowing the process of fermentation to proceed until most of the grape sugar is turned to alcohol. Sugar which escapes this process gives to certain wines, notably port wines, their sweet, fruity flavour, and wines having much sugar in them are known as *sweet* wines. Such wines as claret, Burgundy, Rhine wine, and Moselle contain little or no sugar, while sherry, Madeira, port, and champagne contain from two to seven parts in a hundred. Wines are also called *white* and *red*, red wines being those in which the skins of the fruit have not been removed during fermentation. A wine is *still* or *sparkling*, according to the carbon dioxide content. A still wine is one in which the carbon dioxide generated during the process of fermentation has been allowed to escape before it is bottled. A sparkling wine, one which pours with more or less effervescence, is bottled before the fermentation is complete; the carbon dioxide formed after the container is sealed remains in the wine, ready to escape when it is opened. Alcoholic content varies from as little as 7 per cent in certain light wines to 20 per cent in a heavy port.

WINKELRIED, *ving' k'l reed*, ARNOLD VON. A Swiss peasant hero through whose bravery at the Battle of Sempach in 1386, Switzerland won independence.

WINNIPEG, MANITOBA. The capital and largest city of the province, and the fourth largest city in Canada. It is situated in the south-eastern part of the province, 45 miles south of Lake Winnipeg. Population, 218,785 (1931).

Winnipeg is a natural manufacturing centre. Flour and timber mills are the most important industrial plants, but there are nearly a thousand other factories. Slaughterhouse and meat-packing products are large items, as are also structural steel, bricks, boilers, traction engines and other farm



WINNIPEG, MANITOBA
Photo: Canadian National Railways

machinery, boxes, tents, cement, butter, and confectionery. In recent years many fine buildings have been erected. The Parliament buildings are built entirely of native stone. The law courts, Government House, the residence of the Lieutenant-Governor of the province and the modern Grain Exchange are a few of the most notable structures.

The city is entirely of modern growth. In 1870 Winnipeg had only 215 regular residents. It was then transferred to the Canadian government by the Hudson's Bay Company. When the Canadian Pacific Railway was completed in 1886, Western Canada gained direct communication with the East. Winnipeg then became a great distributing centre.

WINTERGREEN. A hardy flowering woodland plant, found in almost all parts of



WINTERGREEN
Photo. Keystone

the northern hemisphere, and so named because its leaves remain green all the winter. It has glossy, oval leaves clustered at the tops of reddish stems. The white urn-shaped flowers are hidden under the leaves. Through the winter, the birds feed on the bright-red berries. The leaves yield a fragrant, pleasant-tasting oil, which is used extensively as a flavouring for sweets, medicine, tooth powders, and similar preparations, and also as a lotion.

Scientific Name. Wintergreen belongs to the heath family, *Ericaceae*. It is *Gaultheria procumbens*.

WIRE. A long, thin, flexible rod of metal, usually round, having a great variety of industrial uses. Telephone and telegraph wires, overhead wires to carry power for tramcars or trolley buses, nails, fences, delicate watch-springs, various kinds of screening devices, and strings for musical and scientific instruments, are some of the

important articles manufactured from wire. Only such metals as are ductile, that is, have the property of being drawn out, are suitable for making wire; the principal ones are copper, iron, brass, platinum, gold, silver, and aluminium, with their alloys.

Until the fourteenth century, wire was produced by hammering metal laboriously into plates, which were then cut into strips and rounded by beating. Machine-drawn wire was produced in England about the middle of the nineteenth century. Steel or iron billets are put through a rolling process, from which they emerge as long rods about a quarter of an inch in diameter.

The making of wire consists essentially in drawing such rods to a still smaller diameter, and this is accomplished by putting them through a series of steel dies. The die has the shape of a funnel with a round vent smaller than the rod. The rod is sharpened at one end by hammering, so that it may be run into the die. As soon as it is passed through the die, the sharpened end is seized with a pair of pincers and drawn far enough to be attached to an upright drum, which rotates on a vertical shaft. This drum is then set in motion, and the wire is pulled through the die and wound on the drum. Wire is annealed, that is, softened and rendered less brittle by being subjected to great heat.

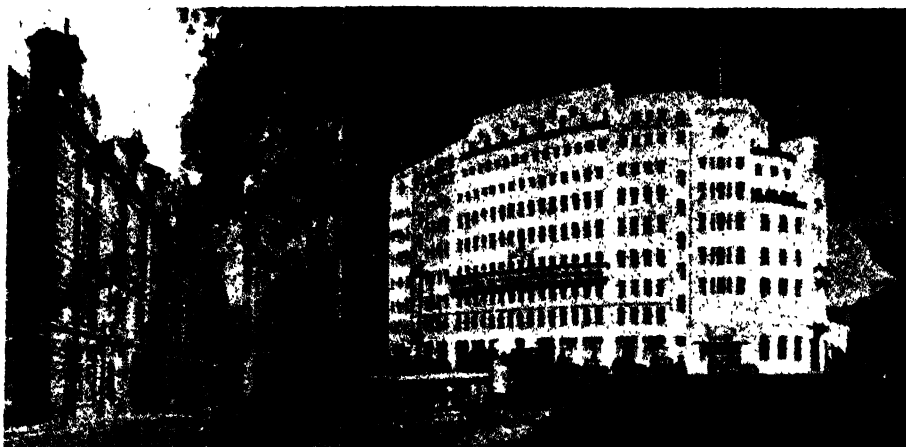
Wire ropes and cables are made of a number of single wires twisted together. Much of the wire used for fencing is *barbed*. Such wire consists of two or more wires, twisted together and having short, thornlike projections at frequent intervals.

WIRELESS COMMUNICATION. The actual birth of broadcasting began much earlier than is generally imagined. Considerable pioneer work was being accomplished quietly and persistently before its achievement was publicly recognized and a general service officially sanctioned.

As in the case of so many inventions, no definite date may be set down with any certainty as to the birth of wireless; nor can any one person claim to be the parent of communication by radio.

Briefly and generally, there was, first of all, the discovery of wireless telegraphy which enabled operators ultimately to signal by the Morse code; then followed wireless telephony, the transmission of actual speech, and finally, with the invention of Professor Ambrose Fleming's thermionic valve, *musical sound* as well as speech could be relayed.

The Scientific Basis of Radio. In wireless communication, whether it be the telegraph or the telephone, the agency of transmission is the electro-magnetic wave. The basic principles of electro-magnetism may be stated



Left THE OLD HEADQUARTERS OF THE BRITISH BROADCASTING CORPORATION AT SAVOY HILL, LONDON
Right THE PRESENT BROADCASTING HOUSE

Photos. B.B.C.

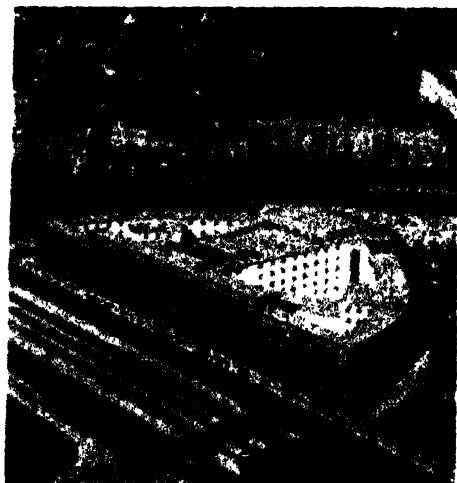
here—namely, that electricity in motion produces a magnetic field, and a magnetic field in motion across an electric conductor produces an electromotive force. These principles were discovered and made known in the first half of the nineteenth century,

circles that move outward from the point of disturbance when a stone is thrown into a pool. Young demonstrated that light travels through space in some such manner, but, of course, by virtue of another medium than water. It is supposed that light waves are undulations of an elastic, all-pervading medium called the *ether*.

(Some scientists of to-day reject the theory of an ether, but the conception is a useful one, and the name is retained in the literature of physics as a matter of convenience.)

Referring again to our analogy of a pool, we must remember that the water particles themselves do not move outward, but up and down, each set of vibrations causing the water beyond to begin to vibrate. We have simply a transverse wave movement, with a series of crests and troughs. If we think of the distance between any two sets of crests as the length of the wave, and the number of crests passing a fixed point in one second as the frequency of the wave, it will be easy to understand the meanings of *wavelength* and *frequency*, as used in the terminology of wireless telegraphy and telephony.

Nineteenth-century scientists accepted the wave theory of light with practical unanimity, and a brilliant mathematician and physicist of Edinburgh, James Clerk Maxwell (1831-79), added to this conception by showing the connection between light and electro-magnetism. In the later years of his life, he proved by mathematics that light consists of transverse undulations of the medium that causes electric and magnetic phenomena, giving us the electro-magnetic theory of light. He also predicted that it would be possible to propagate effects



THE BERLIN BROADCASTING STATION

Photo: German State Railways

during a period that also witnessed considerable investigation of light phenomena.

At the opening of the century, Thomas Young (1773-1829), an English physicist, offered convincing proof of the wave theory of light—that it travels from luminous bodies in undulations similar to water waves. It is easy to visualize the series of widening

through space, in the form of electro-magnetic waves, by means of electrical discharges.

About 1888 a German scientist, Heinrich Hertz (1857-94), actually created such waves by means of a machine called an oscillator. Hertz also demonstrated that the waves can be reflected, refracted, transmitted through insulators, and measured as to length and frequency. He showed that they differ from light waves only in length and frequency.

We know now that the Hertzian waves, as they are called, occupy one section of a vast scale of electro-magnetic radiation, of which about seventy octaves have been identified. All of these rays travel with the speed of light, about 186,300 miles, or 300,000,000 metres, per second, but they differ in wavelength and in frequency. The shortest, which have the highest frequency, are the cosmic rays discovered by Robert A. Millikan. The Hertzian waves, which vary from a few feet to several miles in length, and whose vibrations usually do not exceed 30,000,000 per second, are the instruments of radio transmission. The slowest rate at which light waves are emitted is about 400,000,000,000,000 per second.

About four years after the successful Hertz experiment, described above, Sir William Crookes, in the London *Fortnightly Review*, made this interesting prediction—

"Rays of light will not pierce through a wall, nor, as we know only too well, through a London fog. But the electrical vibrations of a yard or more in wavelength . . . will easily pierce such mediums, which to them will be transparent. Here, then, is revealed the bewildering possibility of telegraphy without wires, posts, cables, or any of our present costly appliances."

Many minds were at work on the problem of making the waves carriers of messages, but of special importance is the contribution of Edouard Branly, a French scientist of the Catholic University of Paris, who devised an improved apparatus for detecting Hertzian waves. In experiments begun in 1890, he demonstrated that these waves were capable of affecting metallic filings, causing them to cohere when the filings were placed in a glass



WORLD'S SM

Photo P & A

tube and the tube made a part of an electric circuit. Sir Oliver Lodge carried on a valuable series of observations with the Branly coherer, or detector, in 1893-94, and in 1895 Professor Popoff, a Russian, made use of it in apparatus for detecting electric waves at a distance. These and other investigations were all of utmost value to the young Italian scientist Marconi, who is honoured as the inventor of the first practical instrument used in wireless telegraphy.

At this point it will be interesting to know how the electro-magnetic wave, which in everyday experience is an intangible,



Left, THE DRAMATIC CONTROL PANEL AT BROADCASTING HOUSE

Right: THE 500 FT. MASTS OF THE EMPIRE BROADCASTING STATION AT DAVENTRY

Originally these masts supported the long wave aerial of the 5XX station; now they are used for the short wave aerials for the transmissions to Canada and East Africa. The 31-metre aerial is on the left, the 25-metre centre and the 49-metre aerial on the right

Photos: B.B.C.



FIRST TRANSATLANTIC PHOTORADIOGRAMS

This plate sent across from London to New York in November, 1924, shows (right) Calvin Coolidge, then President of the United States, and his Secretary of State, Charles E. Hughes. The painting is the famous *Aurora*.

Photo. Wide World

unknowable thing, can be used as the carrier of sound. In all radio communication, we must have transmitting and receiving apparatus. The transmitter, generally speaking, consists chiefly of apparatus for generating high-frequency alternating currents; and an antenna, or aerial, which, when fed by these currents, radiates electro-magnetic waves into space.

The sounds of voices or instruments at the transmitting end are caught by a microphone. This reproduces, in the form of electrical pressure, the variations of air pressure made by the sound waves. Wires carry these impulses to apparatus that transforms them into electro-magnetic waves. The latter are radiated through the ether, as explained above, are collected by the antenna of the receiving apparatus, and are transformed back into electric impulses. A receiver or loudspeaker then converts the electric signals into sounds.

Wireless in Modern Life. The wireless telegraph has played its part in world affairs since about 1898. In 1896 Marconi conducted a series of successful experiments with his apparatus in England, and also made

his first application for a British patent. Continuing his experiments, he was able constantly to widen the distance between the transmitting and receiving stations, and in July, 1898, reports of yacht races off Ireland were transmitted to the newspapers. In December, 1901, the letter "S" was transmitted from Newfoundland and received at Poldhu, Cornwall. The following February, test-letter signals were received by a steamer at a distance of 2099 miles from the Cornish coast, and on 19th December, 1902, the Atlantic was spanned for the first time by actual radio messages.

From these beginnings, radio telegraphy has firmly established itself as the principal means of communication between ships at sea and between ships and shore, while a multitude of stations on land serve to make the world a neighbourhood of communicating nations.

Radio telephony as we know it to-day owes much to a delicate instrument invented by Professor Ambrose Fleming in the thermionic valve. Engineers in many laboratories in England and abroad, working in the one case to devise a telephone repeater, and in

the other to discover improved apparatus for X-ray and power purposes, developed the thermionic valve till it was incorporated in the home radio receiving set. Since 1915, when engineers proved radio telephony practicable, services have been installed which link up practically the whole world.

The limited number of air channels, the need for privacy in message-sending, and the cost of wireless-telephone apparatus, all tend to maintain the older type of telephone in its present supremacy in private and business life.

To-day in England the British Broadcasting Corporation holds the monopoly of broadcasting and will undoubtedly continue to do so under Government control. It is a far cry from the opening of the London station "2LO" in 1922 to the present-day and the imposing Broadcasting House in Portland Place; progress has been so gradual that few realize the initial struggles and the many subsequent problems that those in charge of the broadcasting service had to contend with.

In 1935 no fewer than 68,795 hours 38 minutes were devoted to programmes, this figure excluding the Empire station, and it is interesting to know that the average breakdown percentage was only .026. The Empire Station transmitted for 11,062 hours 28 minutes.

Early in the year 1935 the new Midland Regional transmitter at Droitwich came into service, and at the same time a re-arrangement of the wavelengths of some of the British transmitters was made in order to distribute the service more evenly.

Constructional work has been carried on in connection with three new stations at Lisburn, in Northern Ireland, at Burghhead in the North of Scotland, and at Bewclay in Northumberland. A site has also been purchased at Beaumaris, on the Isle of Anglesey, for a relay station to serve North Wales. Extensions to the Empire Station at Dventary are in hand.

In Glasgow new studio headquarters are in process of construction, while in London four new studios have been equipped at Maida Vale, these to accommodate the military band, orchestral and dance band performances.

Between January and November, 1935, as many as ninety-nine programmes originating on the Continent were relayed by line to London. Of these ninety were successful, six partly successful, and only three unsuccessful. Of the full total, thirty consisted of talks from Geneva and fifteen originated in Paris.

Following the "findings" of the Television Advisory Committee, a portion of Alexandra

Palace was adapted for use as a television transmitting station. See TELEVISION.

Wireless Telegraphy. Communication by wireless telegraphy is carried on by means of two distinct types of apparatus; namely by damped wave transmission and by continuous wave transmission. The latter may be subdivided into interrupted continuous waves (or I.C.W. for short) and to uninterrupted continuous waves. Damped wave transmission has been out of favour for some years owing to the comparatively wide band of interference it sets up, but as it forms an important part of wireless technique, it is described briefly here.

Damped Wave Transmitters. Intelligence is conveyed in damped wave transmission by a series of groups of waves, each group

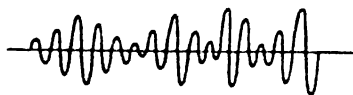


FIG. 1

consisting of a number of waves of varying amplitude. Damped waves are shown diagrammatically in Fig. 1. The number of groups transmitted per second is known as the group frequency.

The most commonly used generator of damped waves is the combination of condenser and spark gap, and the fundamental circuit arrangement is seen in Fig 2. Alternating current from the mains supply is stepped up by transformer *T* and charges condenser *C* through the high frequency

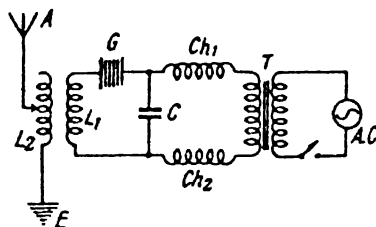


FIG. 2

chokes *Ch*₁ and *Ch*₂. When the condenser voltage reaches a certain value, the condenser discharges across the spark gap *T* consisting of a number of plates arranged in close proximity. The charge in the condenser oscillates round the circuit *CGL*, and induces a voltage in the aerial inductance *L*₁, the damping of which is largely determined by the constants of the aerial circuit consisting of aerial *A*, coil *L*₁, and earth *E*. After the current from *C* has oscillated a few times it is quenched by the spark gap arrangement, and a certain period has to elapse before the condenser is charged again.

and induces another set of damped waves into the aerial. Chokes Ch_1 and Ch_2 prevent the condenser discharging through the transformer secondary winding, but allow the condenser to be charged by the A.C. The key K interrupts the supply current according to the code being employed. In practice

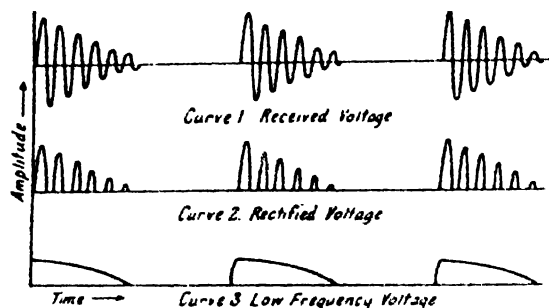


FIG. 3

the frequency of the series of condenser discharges (spark frequency or group frequency) is from 1500 to 2000 per second.

Damped Wave Receivers. The ether wave is picked up by an open or aerial circuit at the receiver. In order to render it intelligible, the group frequency has to be selected and made audible. This is done by cutting off one-half of the complete signal by means of a detector, the remaining series of short impulses being then integrated and applied to the reproducing device.

In Fig. 3, the translating process at the receiver is depicted. Curve 1 shows the series of groups of received damped oscillations applied to the detector; curve 2 represents the impulses after the detector has cut off the lower half of the waves; and

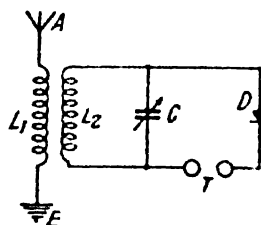


FIG. 4

curve 3 depicts the response of the receiver telephones or loudspeaker.

The simplest circuit arrangement for receiving damped waves is shown diagrammatically in Fig. 4. Ether waves induce a voltage in the aerial A which pass to earth through L_1 and thereby set up a corresponding voltage in L_2 . Coil L_2 is tuned by variable condenser C , to the high frequency

of the waves, i.e. the number of alternations per second of the voltage represented in Curve 1, Fig. 3. This frequency is numerically equal to 300,000,000 divided by the wavelength in metres, e.g. on a wavelength of 300 metres, the radio or high frequency of the signal is 1,000,000 cycles per second.

As this high frequency carries the actual signal it is termed "the carrier wave." When the circuit L_2, C is tuned to the incoming carrier wave, a voltage is applied to the detector D which rectifies the signal as shown in Curve 2, Fig. 3. The rectified impulses pass through the telephones T and produce a mean alternation in magnetizing force corresponding to Curve 3, Fig. 3, and this causes an audible note in the earphones.

Continuous Wave Transmitters.

The requirement for continuous wave transmission is that each of the individual waves forming the complete signal shall be of equal amplitude. For telegraphic communication, the wave may be interrupted by the operating key in

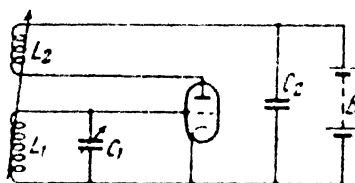


FIG. 5

accordance with the prearranged code (usually the Morse code).

For producing the continuous waves, a thermionic valve is set into oscillation. One method of doing this is to feed back energy from the output circuit to the input circuit by an arrangement as shown diagrammatically in Fig. 5. Voltage coupled from L_2 to L_1 is amplified in the valve with the result that the actual voltage fed back increases until a point of equilibrium is reached at which the feed back equals the energy loss due to the input circuit damping and thus continuous oscillations take place. Circuit L_1, C_1 is tuned to these oscillations, and if L_1 is coupled to another circuit the latter will have induced into it voltages of the oscillatory frequency.

Continuous Wave Receivers. The high frequency of the continuous waves at the receiver is brought down to within the audible range by means of a local oscillator. This is made to generate oscillations at a certain frequency difference from the received signals, and both oscillations are then

combined and produce low frequency beats. These beats are rectified and passed to the reproducing device. A simple circuit for continuous wave reception is given in Fig. 6. The parts indicated with the same letters to those of Fig. 4, operate in a similar manner. In Fig. 6, *O* is the local oscillator

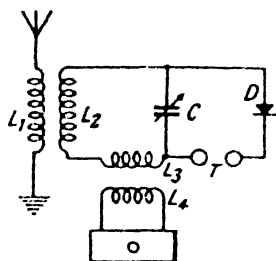


Fig 6

generator, coupled by L_4 to the tuned receiver circuit coil L_2 . The circuit tuned to the incoming high frequency is L_1, L_2, C , in which also the beats occur, these being rectified by D . If the incoming signal has a frequency of 1,000,000 cycles per second, and the oscillator O is set to 998,000 or 1,002,000 cycles per second, the resultant beat frequency is 2000 cycles per second, and this is heard in the telephones T .

Interrupted continuous waves may be received by use of the circuit of Fig. 5, or by any of the detectors feeding L.F. circuits described in the subsequent sections of this series. It is preferable, nevertheless, to employ a local oscillator during reception of I.C.W.

Wireless Telephony. For the transmission of sound, the systems outlined above are of no use. Pure uninterrupted continuous waves are necessary to act as the carrier of the modulation representing the sound transmitted. A telephonic trans-

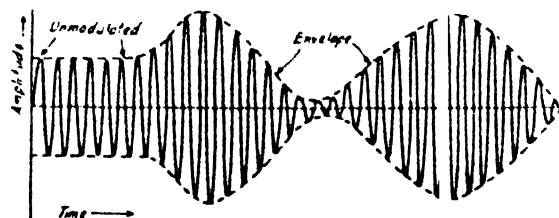


Fig 7

mission may be represented by the curves of Fig. 7, which shows the carrier wave in its unmodulated and in modulated condition. The envelope of the continuous waves is seen to be very ragged on both sides of the datum line and it is this alteration in shape of the wave envelope that sets

up the audible sound at the receiver. The intensity of the sound that modulates the carrier is proportional to the depth or degree of modulation seen in Fig. 7. That is to say, a very loud sound such as a bass drum would produce 100 per cent modulation (maximum possible) whereas a weak sound, for instance a whisper, might modulate the carrier by only 5 per cent. It will be noted that during modulation the individual amplitudes of the carrier wave become correspondingly greater and less than the mean unmodulated amplitude; i.e. at 100 per cent modulation the carrier amplitude varies between zero and double the unmodulated value.

Radio Telephony Transmitters. It is thus seen that essential requirements for a radio telephone transmitter are (1) a source of continuous waves, and (2) a means of modulating these waves according to the intensity of sound to be transmitted.

In practical transmitters it is usual to employ a separate valve as oscillator, the

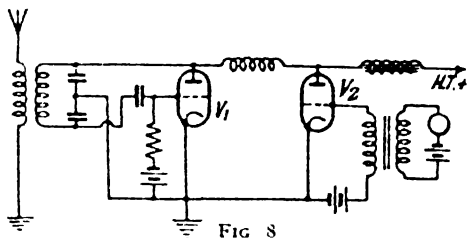


Fig 8

modulation voltage being impressed on a modulation valve. The modulated carrier is then amplified and applied to the aerial circuit.

A practical type of transmitting circuit is given in Fig. 8. Here V_1 is the oscillator valve and V_2 the modulator valve. The voltage variations set up on the grid of the modulator valve produce amplified voltage fluctuations in the anode circuit, and these influence the anode voltage applied to the oscillator valve. The oscillator wave form is thereby influenced in the cadence of the original voltages impressed upon the grid of the modulator valve. This system is known as anode modulation, and is employed in a very large number of broadcast transmitters all over the world.

Receivers of Radio Telephony. In the outline of damped wave reception it was shown that to produce an audible indication corresponding to the signal, it was necessary to cut off half of the received wave-form. Radio telephone signals are, in effect, damped wave signals, because the carrier, although

of constant amplitude when unmodulated (see Fig. 7), is damped by the modulation voltage. For reception of radiotelephony, therefore, similar apparatus is required to that needed for damped wave reception, and in the outline that follows, it may be taken for granted that the phenomena described are applicable to damped (spark) signals or wireless telephony.

Detectors. As the need for detection has been already outlined (see Fig. 3), only the means of obtaining it will be considered here. In order to cut off one-half of the incoming signal, a device with a characteristic similar to that shown in Fig. 9 is used.

The modulated carrier voltage input to the detector device produces proportional instantaneous current in the output circuit. For example, the large input voltage V'

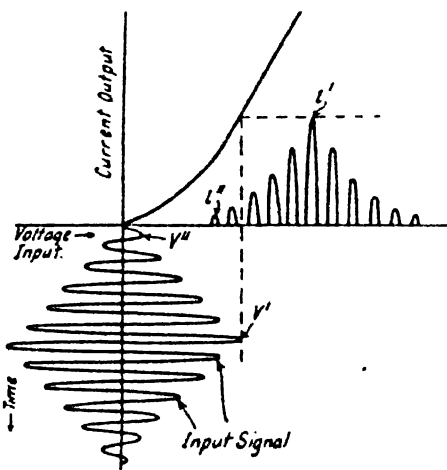


FIG. 9

carries the current in the output circuit up to the peak value i' , whereas the small input voltage V'' (corresponding to a weak signal) only produces the low value of output current represented by the point i'' . It is seen that the positive values of input voltage, i.e. the half cycles on the right of the line V_0 , produce an output current, but that the negative half waves do not have any influence on the output owing to the non-conductivity of the device of which the characteristic is now being considered. There is zero conductivity in the detector, therefore, in respect of negative input voltages. Such a device is called a unidirectional conductor.

Types of Detector. Various kinds of devices have a working characteristic similar to that given in Fig. 9. Crystal detectors—carborundum, galena, iron pyrites, etc.—are

examples, and so are diode, triode, screen grid and pentode vacuum valves and the metal rectifier. Each particular type has specific uses, but crystals are not employed much in modern reception.

Diode Detectors. These are employed almost universally in high gain receivers

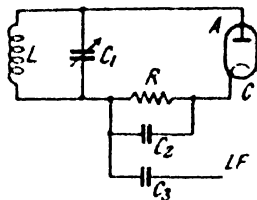


FIG. 10

owing to their ability to handle the high input voltage without distorting the wave form. They are not suitable in low gain or small receivers, where sensitivity to weak signals is desirable, owing to the fact that they do not amplify.

A circuit for diode detection is seen in Fig. 10, where L is tuned by C_1 to the carrier frequency of the signal (i.e. the wavelength of the transmission being received). The carrier voltage across the tuned circuit (Curve 1, Fig. 3) is applied to the anode of the diode and causes a current to flow from the cathode C to anode A inside the valve envelope as seen in the characteristic of Fig. 9. This current flows round L and R back to the cathode, and in so doing sets up a voltage along R that corresponds to the average value of the half wave impulses seen at Curve 3, Fig. 3. These are the low frequency voltages of the signal and they are coupled by condenser C_2 to the low frequency amplifier and loudspeaker. Condenser C_2 is to by-pass the high frequency part of the signal current round R so that it will not interfere with the low frequency signal.

Grid Detector. The triode, screen grid valve and pentode may be employed as

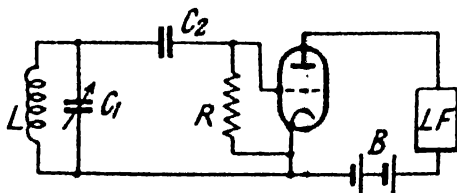


FIG. 11

grid detector or anode detector. In Fig. 11 is given the circuit for grid detection. Tuned circuit L_1C_1 applies the modulated carrier voltage to the grid via grid condenser C_1 .

Resistance R is the grid leak, and its function is to pass the current from grid to cathode. Before the signal voltage is applied to the grid, a small current passes from cathode to grid inside the valve, and back to cathode through R . Owing to the position of C_2 , which blocks the direct current path round L_1 , the current drawn from the electron stream inside the valve must pass round R . This sets up a voltage which makes the grid slightly negative with respect to the cathode. When the signal voltage arrives, the positive half waves on the grid make it draw more current from the cathode, with the result that the grid voltage is varied by the flow of current along R due to the charge on the condenser C_2 . As the flow of current in the anode circuit is controlled by the grid voltage, the resultant anode alternating current is proportional to the signal input voltage, and this is made to set up a low frequency voltage which is passed to an amplifier for reproduction purposes.

It should be noted that detection takes place between grid and cathode, the detected voltages being amplified in the anode circuit. Grid detection is commonly used in small receivers where sensitivity is important.

Anode Detection. In this type of detector, the characteristic made use of is the anode current/grid voltage curve. A grid bias battery is necessary in order to operate the valve on the most effective part of the characteristic, i.e. near the bottom bend. This battery is indicated by B , Fig. 12, which shows a normal anode detection circuit. Tuned circuit LC applies the signal voltages directly to the grid, and owing to the shape of the curve already mentioned, the positive half waves produce a variation

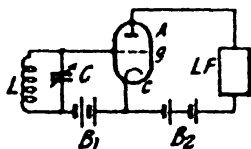


FIG. 12

in anode current flow in the anode circuit. This varying anode current is passed through the low frequency coupling device, such as a resistance, and produces an L.F. voltage for subsequent amplification as in the other detectors.

Reaction. Referring to Fig. 5, it was seen that when the coupling between coils L_1 and L_2 was sufficiently great, the feed back between anode and grid set the valve into oscillation. Now, up to the point where oscillation starts, the resistance of the tuned grid circuit is reduced by this feed back. In grid and anode detectors, this feed back

effect, or reaction, has the desirable quality of improving the ability of the tuned circuit to select the wanted station, i.e. the selectivity, and also of increasing the output voltage. Once oscillation has broken out, the telephony is spoilt.

HIGH FREQUENCY AMPLIFIERS

It is frequently desired to amplify the received signal voltage before applying it to the detector. In fact, most detectors work more satisfactorily when a strong signal voltage is applied to them. In so-called straight receivers amplification is carried out at the carrier or high frequency of the signal, whereas in superheterodyne receivers the high frequency is reduced to a lower or intermediate frequency, which is then amplified.

High Frequency Amplification. This is performed by screen grid valves or tetrodes, and high frequency pentodes or screened

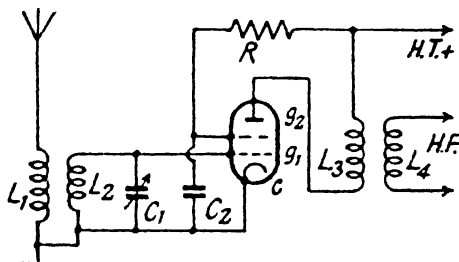


FIG. 13

pentodes. Triodes were formerly employed for H.F. amplification, but great difficulty was experienced with undesired feed back due to inherent capacity in the valve itself. By interposing an additional electrode between control grid (nearest cathode) and anode and keeping this at cathode potential with respect to H.F. currents, the feed back between anode and control grid circuits is avoided. In Fig. 13, g_2 is the screen grid, and by the connection of C_2 , which must be non-inductive, between it and earth as shown, the screen is maintained at earth potential so far as H.F. currents are concerned. Actually a steady voltage from the H.T. supply is applied to the screen grid, as this assists the passage of the electrons from the cathode to the anode. The screen grid voltage is usually less than half the anode voltage.

The working of Fig. 13 is as follows: incoming signals pass from aerial to earth through L_1 and induce a voltage of carrier frequency in L_1 . This coil is tuned by C_1 to the carrier frequency and a voltage is produced across the tuned circuit which is

applied between the control grid and cathode. Now a fluctuating voltage on the control grid is reproduced in an amplified form in the anode circuit, and this is applied to L_1 , which induces a corresponding voltage wave form in L_2 , the latter being connected to either a further H.F. amplifier or a detector.

Pentode. The pentode (five electrode) valve has one grid more than the screen

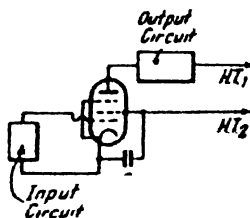


FIG. 14

grid valve. This extra grid is situated between the screen grid and anode and is connected in most instances directly to the cathode as shown in Fig. 14. The third grid is called the suppressor grid and enables a much greater anode current swing to be obtained than with the screen grid valve, and can thereby handle a much larger input voltage without distorting.

Superheterodyne Receiver. This is so called because it changes the incoming high frequency to a supersonic frequency by means of a local oscillator or heterodyne. Superheterodyne is an abbreviation of supersonic heterodyne.

The features that distinguish the superheterodyne from the straight receiver, i.e. a receiver in which the amplification is carried out at the carrier frequency, are the

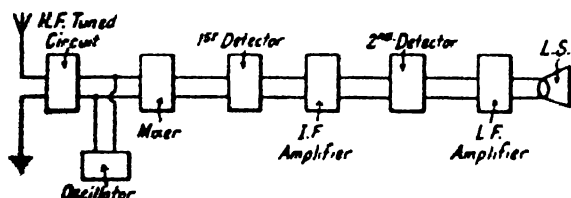


FIG. 15

employment of (1) an oscillator, (2) an intermediate frequency amplifier, (3) a second detector.

The local oscillator generates a frequency (say 1000 k/cs, where k/cs stands for kilocycles or thousands of cycles per second) that differs from the incoming signal frequency (say 900 k/cs) by the intermediate frequency (say 100 k/cs). Signal and locally generated voltages are mixed and the combination voltage is rectified. This produces a modulated carrier wave of frequency equal

to the sum or difference of the two voltages. Usually the difference frequency is selected (100 k/cs in the instance given above) and amplified in the intermediate frequency amplifier. The output of the intermediate frequency amplifier (or I.F. amplifier) is applied to a second detector in the same way as the H.F. voltage in a straight receiver is applied to the detector. If desired, the incoming signal may be amplified at its high frequency before being mixed with the local oscillations. This arrangement is shown schematically in Fig. 15.

LOW FREQUENCY AMPLIFIERS

When a loudspeaker or recording instrument has to be actuated by the received signal, the power supplied by a detector is not sufficient to provide satisfactory results. Hence the need for amplification of the detected or low frequency voltages. In small receivers, one valve between the detector and loudspeaker is commonly

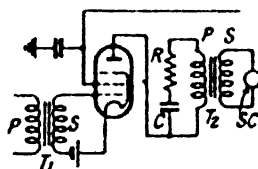


FIG. 16

employed, but in higher gain receivers where a much larger voltage has to be handled, several valves are used.

The process of low frequency amplification is similar to that of high frequency amplification. Transformer and resistance capacity coupling is used between the low frequency or L.F. valves.

A typical transformer coupled valve circuit is seen in Fig. 16. Current fluctuations in the primary of transformer T_1 induce stepped-up voltages in the secondary S which are applied to the grid. An amplified voltage appears in the primary P of the output transformer T_2 , and this is stepped down to the secondary S and fed to the speech coil SC of the loudspeaker and thus produces audible sound as described under the heading "Loudspeakers."

Resistance-Capacity Coupled Amplifier. In this type of amplifier, a resistance element is connected in the anode circuit of the amplifier valve and the voltage fluctuations along it that are brought about by the varying anode current, are transferred to the following valve by a condenser. This arrangement is seen in Fig. 17, where R_1 is the anode resistance and C the coupling

condenser. The valve V_1 must have a grid resistance R_1 to enable C to discharge. The coupling condenser serves the purpose of preventing the anode potential of V_1 being applied to the grid of V_2 and thus destroying the valve. Consequently, C should be of good quality. For satisfactory results, R_1 should have a value about three times the impedance of V_1 , C may have a capacity of 0.01–0.05 microfarad, and R_2 may have a value of from a quarter to one megohm.

Resistance-capacity coupled stages are used a great deal in modern receivers, owing to the high fidelity in reproduction that it is possible to obtain from them, and also because the anode current consumption of the valves is very small. The latter point is due to the presence of R_1 in the path of anode current. There is less gain in a resistance-capacity coupled amplifier than

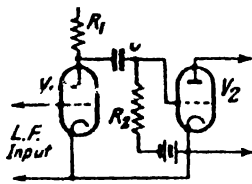


FIG 17

in a transformer coupled amplifier owing to the voltage step up of the transformer.

Impedance Coupled Amplifier. If R_1 in Fig. 17 is replaced by a L.F. choke with an impedance equal to about three times that of V_1 , the amplifier will work in a similar manner to that outlined above. Higher amplification can be obtained than with resistance capacity coupling owing to the higher voltage that is applied to the anode of V_1 due to the much lower H.T. voltage drop along the resistance of the choke as compared with that along R_1 .

Push-pull Amplifier. When a large signal voltage has to be handled by the L.F. amplifier, a push-pull amplifier is often used owing to its ability to do this and yet provide a high degree of quality in the reproduced signal. The large signal handling capabilities of a push-pull amplifier are due to the splitting of the input voltage between the grids of the two valves, as seen in Fig. 18, so that each valve actually receives only half the total voltage. At the instant the grid of V_1 is positive, the grid of V_2 must be correspondingly negative owing to the cathodes being connected to the centre of the secondary of T_1 through the grid bias battery B_1 . This produces a change in

steady anode current flow from the two valves in opposite directions, i.e. as the anode current of V_1 increases from its steady no-signal value, the anode current of V_2

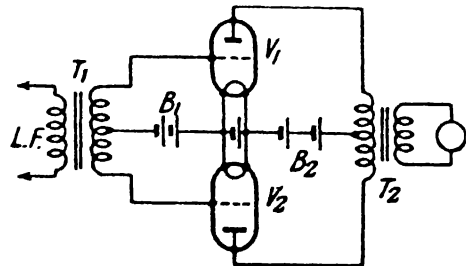


FIG. 18

will decrease correspondingly. These effects are additive in the primary winding of T_1 , however, and the total L.F. voltage across the whole primary winding is double that produced by one valve.

Class B Push-pull. In this type of amplifier, each of the push-pull valves is operated in such a way that the grid is allowed to be made positive and so draw a considerable current from the electron stream inside the valve. By working the valves in this way, a gain in efficiency is obtained and great economy in anode current results with the correct design of valve. The circuit is seen in Fig. 19. Grid current flows round the secondary of T_1 , which must therefore be of low resistance to avoid an excessive loss of power. To supply the power for driving the Class B valves positive, a driver valve V_1 is necessary, and this enables the full swing of signal voltage to be applied to the push-

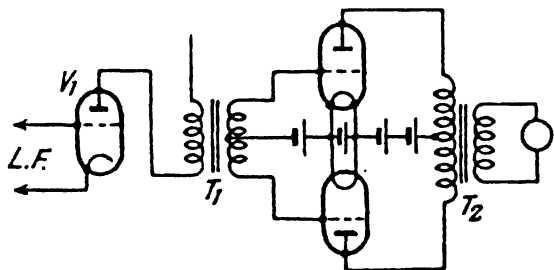


FIG. 19

pull valves. Only especially designed Class B valves can be used in this arrangement.

Quiescent Push-pull Amplifier. With the object of reducing the flow of anode current to the minimum, the grid bias applied to two pentodes in push-pull is increased well beyond the normal limit for satisfactory amplification when one valve is used. The result of this is that each valve is only

operated when its grid is made more positive by the signal voltage. Since, as has already been shown, one control grid is positive when the other is negative, only one valve is actually in use at any moment. The grid bias applied reduces the anode current to a low value, and thus it is seen that the total anode consumption is very small during

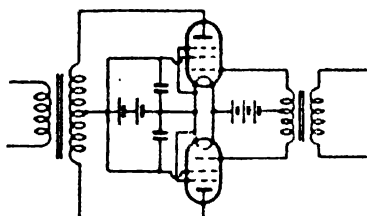


FIG. 20

no-signal periods, and during reception is roughly proportional to the signal strength. No grid current flows in a quiescent push-pull amplifier, and therefore no driver valve is needed. The general arrangement is shown in Fig. 20.

Mains Power Supply Units. The cost of dry battery power for radio receivers is about £3 per Board of Trade unit. As the cost of a unit from the electric supply mains is only a few pence, it is obviously an advantage to employ the mains as the source of power. Quite apart from economics, a mains driven receiver is much more satisfactory in quality and in the gain per valve. For A.C. mains a rectifier, either valve or metal rectifier, must be used, but for D.C. mains no rectifier is needed.

Valve Rectifier Units. The circuit arrangement is shown in Fig. 21. Alternating voltage is applied to the primary of the mains transformer T and is changed to the required voltage for the various purposes by the particular turns ratio. For H.T. (anode voltage) supply, the secondary winding S_1 applies a high voltage to the anodes of the valve. When one end of S_1 is positive the other is negative, and since the electron current inside the valve only flows when the anode is positive, it follows that current flows to each anode alternately when the particular winding end to which it is connected is positive. The resultant anode current flow is indicated by arrows, the currents being combined in the H.T.-lead. From S_2 , current is supplied to the heater of the rectifier valve, and the centre point of S_2 is tapped to form the positive H.T.-lead. Winding S_3 supplies the heater current for the receiver valves.

Smoother Circuit. The rectified current provided by the rectifier is unsuitable for use in a wireless receiver owing to rapid fluctuations that take place in its instantaneous values. For the purpose of smoothing out these fluctuations or ripple component a smoother or filter circuit consisting of iron-cored choke Ch and condensers C_1 , C_2 is employed.

Battery Eliminator. When a receiver is fitted with battery valves, the filaments may be heated from an accumulator and the anodes supplied by a mains unit of the type shown in Fig. 21. In this case the auxiliary winding S_2 will not be required. Metal rectifiers are mostly employed in battery eliminators, as this type of apparatus is called.

Mains Valves. There are three main groups of mains valves, as follows—

1. Indirectly heated; 2. Directly heated; 3. A.C./D.C. or Universal valves

Type 1 have a separate heater element surrounded by an insulating sleeve which carries a metal covering coated with the electron emitter or cathode. In type 2 the cathodes are very robust and are heated in a similar manner to ordinary battery valves. Type 3 are usually indirectly heated and adapted to be run at a higher voltage than the A.C. valve so that several valves may be connected in series across the mains supply. When valves of type 3 are used with A.C. mains, the supply current is rectified.

AERIALS

Although the forms of aerial are very numerous, they may be broadly classed as either directional or non-directional. For broadcasting, non-directional aerials are

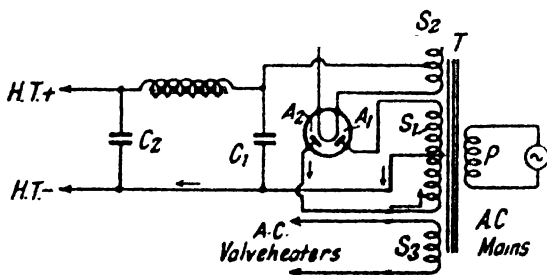


FIG. 21

employed on medium and long wavelengths, while for the short waves, directional aerial systems are found most advantageous. Height is one of the important things to be aimed for in most aerial systems. The aerials outlined below are employed for both transmission and reception.

Non-directional Aerials. Non-directional aerials may be single vertical wires or in the

form of a T or inverted L. The latter type may be made fairly directional by increasing the length of the horizontal limb to such an extent that it is several times—or at least five times—longer than its vertical limb. Both T and inverted L types may have several wires in the horizontal section, and are then sometimes called "carpet" aeriels. Other types of non-directional aerial are the cage aerial consisting of a number of wires spaced round the surface of a cylinder, the umbrella aerial in which a number of wires radiate in all directions from a central supporting pole, and a large variety of proprietary brands designed for broadcast reception.

Beam Aeriels. Suppose that, instead of radiating the ether waves over the whole 360° , transmission is concentrated within an arc of only 10° . To signal to a station at P would then require only $\frac{1}{36}$ th = $\frac{1}{36}$ of the energy, other factors being equal. On the other hand, any receiver outside the beam of transmission will not pick up any energy, as radiation does not reach it. This explains why beam systems are so much more economical in working.

A large number of different types of aerial arrays produce a beam transmission. The fundamental principle of their working is that if a reflector is placed a certain distance behind the aerial—usually about one quarter of a wavelength—the wave is retransmitted by the reflector. This reflector retransmitted wave is in phase with the wave from the aerial in the direction of the aerial, and the two energies are additive. In the other direction the reflector and the aerial waves are in opposite phase and thereby cancel out. It should be noted that, since the two energies are additive in the desired direction, there is actual magnification as compared with the transmission of a single wire aerial.

The magnification obtainable from a beam aerial array is proportional to the number of wavelengths it is wide. If a number of wires are employed, they act in a similar manner to a sheet. Height of aerial in wavelengths is also a determinant as regards magnification, and by suitable design a beam aerial system may be made to provide a magnification of over two thousand times.

It is only practicable to construct beam aeriels for the short wave transmissions owing to the relation mentioned above of the physical dimensions of the aerial array with the wavelength of transmission. Beam systems are in general use all over the world for long distance communication.

Frame Aerial. This consists of a number of turns of wire on a rectangular former or framework. Incoming waves induce voltages

that are in phase in the horizontal limbs but out of phase in the vertical limbs. The in-phase voltages cancel while the out-of-phase voltages produce a resultant voltage dependent upon their difference of phase. Since this is greatest when both vertical limbs are in line with the oncoming wave-front, the plane of the frame aerial will be in the direction of the transmitting station at the point of maximum signal strength. The frame aerial is thus directive. It is, in fact, used very widely for direction finding purposes at receiving stations, but seldom at transmitters.

Loudspeakers. Although several kinds of loudspeaker are possible, the moving coil type is universally employed in receivers of all classes and cost. This is because the quality of reproduction it provides is superior

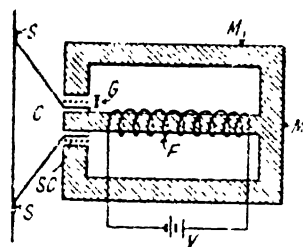


FIG. 22

to that of any other type for a given cost. Two or more moving coil loudspeakers can be used together to give a combined acoustical output, or auxiliary loudspeakers of another type can be employed in conjunction with the moving coil loudspeaker to enhance the quality.

The design of a moving coil loudspeaker is illustrated in Fig. 22. A framework M of magnetic iron has wound on its centre limb a field coil F to which a source of voltage V is connected. In the circular gap G between the centre limb and the two other limbs of the magnetic framework is suspended a speech coil SC attached to a light cone C suspended at S . When the voltage V is connected, a current flows round the field coil F and produces a strong magnetic field, the return circuit from the centre limb of the framework being across the gap to the two outer limbs. The speech coil is thus within the influence of this magnetic field, and when a current from the radio receiver passes through SC it sets up an alternating magnetic field that interacts with the steady field due to F . This produces a movement of the cone corresponding in amplitude and frequency to the signal current supplied by the receiver, and thus sets up sound waves in the surrounding air.

In broadcast receivers for mains supply, the field coil F usually forms the choke Ch of the smoothing system of the mains supply unit shown in Fig. 22. It is not necessary to have a field coil, however, as M may be made of permanently magnetic material. The permanent magnet type is used on battery receivers.

Moving Iron Loudspeakers. Under this heading is included all those types in which a permanent magnetic pull on a piece of soft iron is varied by the signal currents and thus causes the iron to vibrate. Moving iron loudspeakers were superseded by moving coil instruments. The earliest types were merely large head telephone earpieces mounted at the base of a horn. An improved version of this is illustrated in Fig. 23. Magnet system M with a magnetic iron

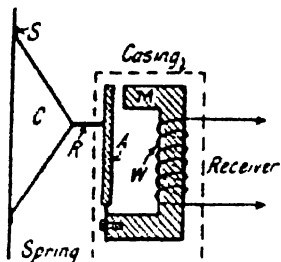


FIG. 23

armature A , fixed to spring Sp , is attached to a reed R and cone C . Before signals are received the pull on A by M places A in a central position. When signal currents from the receiver flow through the winding W , this pull on A is increased or decreased according as the resulting magnetic force due to the signal current assists or diminishes that of the permanent magnet. The armature is thus made to vibrate according to the amplitude and frequency of the signal currents. In balanced armature loudspeakers, the armature vibrates in a rotary manner between two circuits of magnets which repel or attract according to the direction of signal current flow in the winding on the magnet system.

Electrostatic Loudspeakers. These are little more than laboratory instruments, their application to radio receivers being extremely limited. They consist essentially of a fixed condenser plate and a vibratable plate (which need not be made of metal), a steady voltage being applied between them. When a signal voltage is superimposed on the steady voltage the electrostatic forces set up produce vibration of the movable electrode. The electrostatic plates are of large area, and the movement of the vibrat-

ing electrode produces sufficient disturbance in the surrounding air to set up sound waves. A cone or other diaphragm is, therefore, not required.

Piezo Electric Loudspeaker. This is the latest comer to the sphere of sound reproduction. The movements of a piezo electric crystal (outlined under the heading "Crystal Controlled Oscillators") are transmitted to a diaphragm which thereby emits sound waves. Piezo electric crystals are often used in "tweeter" loudspeakers that are employed in high quality sound reproducing systems for the purpose of emphasizing of the upper musical register. Various constructions are possible, but the general principle consists in clamping the edge of the crystal, except at one edge that is left free to vibrate. To the free edge is fitted a drive for the reproducing cone or diaphragm of a horn. Several crystals may be fastened together, their surfaces being separated by metal foil electrodes.

Crystal Controlled Oscillators. In order to maintain the carrier frequency transmission at a given frequency, free from drift, it is essential to incorporate in the transmitter apparatus a device that oscillates at a constant frequency. Specially designed tuning forks are sometimes used for this purpose, but the device that has been adopted almost universally is the piezo electric crystal. These crystals are cut from quartz in a particular manner, and it is found that if a piece of such crystal is placed with its two plane parallel faces in contact with two metallic electrodes to which an oscillatory potential of a given frequency is applied the crystal will vibrate at that frequency and tend to maintain the applied oscillation frequency constant. The specific frequency at which each crystal vibrates depends upon its physical dimensions, and the required size for any particular frequency is produced by grinding the crystal. These vibrations are due to periodic expansions and contractions of the crystal that are caused by the applied voltage.

Stabilizers. The voltage supplied by electric mains is liable to fluctuate to a greater extent than is often desirable for the satisfactory operation of radio apparatus. To overcome the effects of these supply fluctuations, two types of stabilizers are used. One of these, the barretter, maintains a constant flow of current, and the other keeps the voltage at a given level.

A barretter usually consists of a glass tube filled with hydrogen gas into which is placed a piece of iron resistance wire with a high heat coefficient, i.e. as it heats up due to an increase in current flow through it, its resistance rises rapidly. The result of the

increase in resistance is to diminish the current flow, and thus a compensation is effected to a degree depending upon the coefficient of the barretter.

Wired Wireless. This paradoxical term is used to indicate a method of communication in which wireless transmitters and receivers are employed at the terminals of a wired system. The carrier wave is modulated or interrupted in the same way as in wireless communication, the only difference to ordinary wireless being the wired connections between the stations instead of ether. Several channels of communication may be utilized over the same cable on different wavelengths and in addition the usual telegraphic messages may be sent.

Wireless Transmission Range. The power of the transmitter and the sensitivity of the receiver are obviously determining factors in the range of a wireless telephone station. Less apparent factors are: nature of the ground forming the site of the transmitter; the atmospheric conditions; the nature of the country surrounding the transmitter; the height of the aerial. Before a transmitter is installed considerable investigation is necessary to ensure satisfactory transmissions. Wooded areas, for example, weaken the waves far more than open country, and so does hilly land. Much greater ranges over sea are obtainable for a given power. With these provisos, it may be stated that, in general, the strength of the received signal falls off as the square of the distance between transmitter and receiver.

The atmospheric conditions mentioned above do not refer only to the presence of disturbing noises known generally as "atmospherics" but to what may be termed the radio transparency of the atmosphere. Under certain conditions the air is more ionized than others; i.e. it becomes more filled with ions that absorb the ether waves that try to pass through it. At night, for instance, the atmosphere is far less ionized than during the day and consequently the ranges of transmission are much longer.

Direct and Indirect Rays. Between transmitter and receiver there are two paths for the radio signal. It may come directly over the surface of the earth, or it may pass several miles into the sky and be reflected down again. The number of reflecting surfaces above the earth are not known, but it would appear that there are at least three. Nearest the earth is the Heaviside Layer, and then there is *A* the Appleton Layer, while the third layer *E* is referred to as the Eckersley Layer.

Some of the signals pierce the Heaviside Layer and may be reflected by either the *A* or *E* layers.

Fading. From the foregoing it is apparent that the resultant signal energy at the receiving station is composed of several parts which reach it by devious routes. So long as these components are in phase with each other the resultant signal will be satisfactory, but should the out-of-phase components be of approximately equal amplitude, the signal energy will be dependent upon the relative phase. As the phase difference approaches 180° these components tend to cancel out, with the result that the reproduced signal becomes weak. This is how fading takes place. The relative phase of the components depends upon the height of the layer or layers from which the ray is reflected.

Skip Distance. The direct wave from the transmitter may lose all its energy within a comparatively short distance, while the indirect wave may come to earth thousands of miles away. There will be a distance of the earth's surface between transmitter and receiver, therefore, over which the signals are not receivable. This is known as the skip distance.

Ultra Short Waves. Wavelengths below 10 metres are considered ultra short. The transmission phenomena associated with ultra short waves are totally different from those outlined above, as these waves have such a high frequency that they behave like light rays. So far as is known at present, they are not reflected by the upper layers to the same extent as the longer waves, but travel from the transmitter to receiver in a direct line. The range of transmission is thus mainly limited to the optical distance, which increases as the square root of the height. Absorption of ultra short waves by hills, buildings, etc., is very pronounced.

WIREWORM. The name applied to the hard-skinned, cylindrical grubs, or larvae, of click beetles, which live in the earth, usually two or three years, often doing great damage to crops by feeding on the plant roots. They are yellowish in colour and from one-fourth to one-half inch in length. They have three pairs of legs and resemble a piece of wire, hence their name. Rotation of crops will reduce their numbers, but there is no practical method of treating the soil to destroy wireworms.

WISCONSIN. One of the North-Central states of the American Union

It is bounded by America's two greatest inland highways for water traffic; the Mississippi and its tributary, the St. Croix, form all but about 40 miles of the western boundary, and Lake Superior and Lake Michigan, of the Great Lakes and St. Lawrence system, border the state on the north and east for over 500 miles. It has

an area of 56,066 sq. miles, of which 810 sq. miles are water surface. The population is 2,939,006 (1931 census), of which slightly more than half live in towns exceeding 2500 in population.

The principal cities are Milwaukee (population 578,249), Madison, the capital, Racine and Superior.

Wisconsin is a land of low hills and fertile valleys. Its highest elevation follows a ridge of hills extending from north to south. The loftiest of these, Rib Hill, rises 1940 ft.

The hay and forage crop is the most important in the state. The most important grain product is oats. Maize is next in acreage to oats, and barley, rye, potatoes, hemp, and tobacco are other large crops. Dairy farming and vegetable growing are carried on, and in connection with dairy farming the manufacture of butter, cheese and condensed milk. The quarrying of stone, including sandstone, limestone, and granite, is important.

Other industries include the manufacture of motor vehicles, the making of foundry and machine-shop products, electrical machinery, turbines, and the like. Paper, wood pulp, paper products, lumber, and timber products are next in importance.

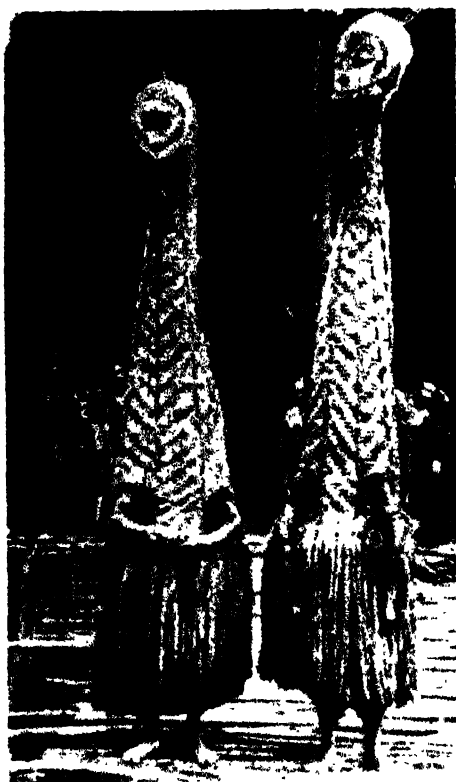
WISTARIA, *wis fair' ta*. Genus of flowering climbers belonging to the pea family. The best known variety has graceful clusters of bluish-lavender blooms. The flower clusters are commonly one or two feet in length.

Scientific Name. The wistaria belongs to the family Leguminosae. The species described above is *Wistaria chinensis*.

WITCHCRAFT. The term in general refers to the prevalent belief in and practice of bewitchment by casting a spell, but more commonly to the special varieties of the belief and the practices connected with it that have existed in Christian times in Western Europe. The belief in witchcraft is a reaction of the primitive mind, which is ready to detect in the incidents and accidents of life the workings of spirits or demons, and to believe in the possession of mystic powers by favoured individuals. The use of the power to inflict injury is *witchcraft*. It may emanate directly from the individual, as in the "evil eye"; but usually it requires a proper ceremony or incantation to fix the spell. The agency that makes the spell work may be (and in developed forms of witchcraft generally is) regarded as a spirit, or may be vaguely conceived as part of the operations of nature.

The object through which the bewitchment takes place is, if possible, a part of the person of the victim—the paring of his

finger-nails, a lock of his hair, a bit of his clothing, or some article which he has touched or used, but it may be an object chosen to represent the victim. By burning or piercing it with thorns, or by reciting a potent formula, using the victim's name, the injury that is wished and acted will be transferred to the bewitched person. Hence, there arose the practice of destroying finger-nails, cuttings of hair, even scraps of food,



WITCH DOCTORS IN PAPUA
They are wearing goblin masks for a mask dance.

Photo. Fox

so as to prevent their being used as a means of bewitchment; hence also came the concealment of the true name and the use of another in ordinary intercourse. Bewitchment may extend to cattle and crops; the blight may be cast upon all one's possessions and ventures.

In the special sense, witchcraft implies the co-operation or command of a spirit or demon. The bewitched person becomes possessed, and the driving out of the demon is the act of exorcism. The existence of laws making witchcraft a crime shows how

continuously the belief flourished from Roman days, and earlier, to recent times.

The historical persecutions for witchcraft owed their incentive to the zeal of the guardians of the Church, for both historically and in its cults medieval witchcraft was closely akin to pre-Christian paganism. It is estimated that 300,000 women perished under the charge of witchcraft between the years 1484 and 1782. In the sixteenth, seventeenth, and eighteenth centuries, under the leadership of churchmen, outbreaks of accusation of witchcraft arose from time to time in Germany, England, France, Spain, and Italy. It was a gradual growth in education, allied with a waning in superstitious beliefs and a growing aversion from cruelty, which ended the persecutions and recognized the delusions on which the theory of witchcraft is based.

In England, the last trial for witchcraft occurred in 1722; the suspect, a woman, was not convicted. In the same year, the last execution occurred in Scotland, and was followed in 1723 by laws repealing the statutes relating to witchcraft.

WITCH-HAZEL. A tall shrub native to North America, easily distinguished by its jointed and curving branches. The forked



WITCH-HAZEL
Bloom and fruit.

Photo: Visual Education Service

twigs were used by treasure-seekers as divining rods, and because of the supernatural power the plant was thus supposed to possess, it was called the *witch-hazel*. See HAZEL.

In October or November, after the falling of the leaves, the straggling branches are re clothed with the feathery, golden clusters of the long-delayed flowers. The fruits do not ripen until the following year.

The bush is important as the source of the astringent healing and tonic lotion known as witch-hazel, or *hamamelis*.

Scientific Name. The witch-hazel belongs to the family *Hamamelidaceae*. It is *Hamamelis virginiana*.

WITENAGEMOT, *wit en a ge môt*. The meeting of the wise men, the supreme council of England in the Anglo-Saxon period. It probably included the bishops, ealdormen, or territorial governors (later earls), and thanes, but its composition seems to have depended on the will of the King, who would summon any counsellors he chose. Before the union of the Saxon kingdom, each small kingdom had its own Witenagemot. The Witan, as it was also styled, enacted secular and sacred laws, assented to land grants, voted on war or peace, was a court of last resort, and approved the appointment of ealdormen and bishops. The power of electing a king when the succession was uncertain, and of dethroning a negligent sovereign, has been claimed for it, but this is now held to be an overstatement, its "right of election" being probably little more than acclamation. The Witenagemot disappeared after the Norman Conquest.

WITTE, *wit'c*, SERGEI YULIEVITCH, COUNT (1849-1915). A Russian statesman, born at Tiflis, in the Caucasus. Becoming Finance Minister in 1893, he did much to develop railways throughout the empire, and to promote home industries by means of tariff protection and foreign capital. Witte's foreign policy had as its central aim the freeing of Russia from economic dependence on other nations. He also extended Russian influence in Northern China and in Persia.

Differences with the Emperor and lack of popular support led to his resignation in 1906 from the position of President of the Ministry which was in power after the Russo-Japanese War.

WOAD. Name of a leafy, many-branched herb bearing yellow flowers, found in Great Britain and the Mediterranean countries. It was formerly cultivated for a blue dye obtained from its leaves, with which the ancient Picts are believed to have stained their bodies.

WOLF. Large members of the dog tribe, found in Europe, Asia and North America. An adult wolf is about 5 ft. in length, including the tail. The wolf is long-legged and lanky in appearance, with erect ears, long snout and oblique eyes. The colour of the coat varies but it is generally greyish, and



WOLF IN WHIPSNADE ZOO
Photo Topical

the thickness of the fur is greater in those animals living farthest north.

At one time the wolf was quite common in Britain. In England it was exterminated in the seventeenth century, and later in Scotland and Ireland.

In America there are two varieties, the grey or timber wolf and the coyote or prairie wolf. The latter is still numerous.

WOLF, TASMANIAN. See **TASMANIAN WOLF.**

WOLFE, JAMES (1727-1759). A British general whose successful campaign at Quebec gave Canada to the British Empire. He early

saw service in Scotland and Flanders. Sailing to America, he served as brigadier general in the Louisburg expedition under Amherst. After a brief period of semi-retirement he was raised to the rank of major general and at the request of Pitt undertook the attack on Quebec. With health shattered by disease, after discouraging failures, his efforts were rewarded with success on the Plains of Abraham.

Twice wounded, he fought till he was

mortally wounded by a third bullet, which passed through his lungs, but before he died he was assured of victory.

WOLFHOUND. The common name of several breeds of dogs originally used for hunting the wolf. See **BORZOI**; **IRISH WOLF-HOUND**.

WOLFRAM, OR WOLFRAMITE. See **TUNGSTEN.**

WOLSELEY, woolz' li, GARNET JOSEPH, VISCOUNT (1833-1913). A British field marshal, born in County Dublin, Ireland. He began active service in 1852 in the second Burmese War, and in the next eight years he served in the Crimean War, took part in the Indian Mutiny (which see) and in the Chinese War of 1860. His first independent command was the Red River Expedition against Louis Riel in Canada.

The year 1873 saw Wolseley win the First Ashanti War. When the Egyptian army under Arabi Pasha revolted in 1882, he put down the rebellion and was

made a general and created Baron. His last campaign was at Khartoum in 1884.

From 1895 to 1899, Wolseley was Commander-in-Chief of the army, and this period was devoted to army reorganization and reform.

WOLSEY, wool' zi, THOMAS (about 1475-1530). An English statesman and Cardinal of the Roman Catholic Church, for years the most powerful man in England. He was born at Ipswich and was educated at Magdalen College, Oxford. He was ordained to the priesthood in 1498, and became Rector of Limington, in Somerset. Advancement soon came, and by 1507 he had become chaplain to Henry VII. The king found Wolsey useful as a diplomatic agent, and in 1509 he was given the deanery of Lincoln.

Henry VIII at his accession made Wolsey his almoner (alms-dispenser), and bestowed upon him other ecclesiastical preferments, and in 1511 he became a member of the Privy Council. Before long, his was the controlling voice in all matters of State. His ecclesiastical advancement continued also, for in 1514 he became Bishop of Lincoln, and later in the same year Archbishop of York; in 1515 he received the cardinal's



WOLSELEY
Photo Brown Bros



GENERAL WOLFE
Photo Brown Bros

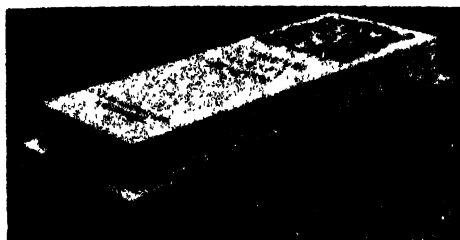
hat from Pope Leo X. He was then in supreme power in England. He lived in royal state, exacted the utmost reverence and subservience from all who approached him, and made no secret of the fact that he hoped to be elevated to the Papacy. Like his royal master, he was lax in his morals, but had undoubted qualities of statesmanship, and was faithful to the king's interests, although his own ambition for the Papacy sometimes affected his policy.

Most of Wolsey's energies were devoted to advancing the cause of England in foreign

the matter to Wolsey, who did not proceed energetically enough to please the impatient monarch. The result was that he was stripped of his honours, except the Archbishopric of York, removed from his high political place, and forced to face a bill of attainder. This failed of passage by the Commons, but Wolsey was accused of treason and summoned to London to meet the charges. On the journey he died at Leicester Abbey, and was buried there.

WOLVERHAMPTON. A flourishing industrial centre in the heart of England with a population of 140,000. It is served by G.W.R. and L.M.S.R., and is intersected by an elaborate system of canals. There is a municipal airport. The town is a municipal, Parliamentary and county borough. Heanton, as Wolverhampton was anciently called, has an interesting industrial history. Occupying as it did a substantial place in the tool trade during the fifteenth and sixteenth centuries, it became increasingly well-known. The finding of coal and other minerals aided the town's growth, and early in the eighteenth century the products of metal working, chiefly of the small variety—locks, buckles, steel toys—became a predominating business. Then there was an enormous tonnage of well-known brands of galvanized corrugated iron sheets which found a ready market both at home and overseas. To-day the town manufactures locks, toys, tinplate, edge-tools, chemicals, artificial silk, rubber tyres, aircraft, steel bearings—in all, there are over 150 diversified industries which have given the town an enviable degree of commercial and industrial stability.

WOLVERINE, *Uolvereen*. A fur-bearing animal of the weasel family. Wolverines are found in the northern woods of America, Europe, and Asia; in the Old World, the



CARDINAL WOLSEY'S TOMB
Memorial tablet over his burial place in
Leicester Abbey.

Photo: Leicester Corporation

affairs. At the outset of his ministry, he favoured France in opposition to the Holy Roman Empire, but later, when Charles V became emperor, he shifted and concluded an alliance with him against Francis I, hoping thereby to win the support of Charles in his struggle for the Papacy. When the empire became so strong that it seemed to Wolsey to threaten the balance of power in Europe, he again took sides with France, thus involving England in a war with Charles in 1528.

When Henry desired to secure a divorce from Catherine of Aragon, he committed



WOLVERHAMPTON

Left: The Art Gallery. Right: Old stone in the churchyard

Photos: Fox; Taylor

species is called *glutton*. The wolverine is a short-legged, heavily built animal, about 2½ ft. long, resembling the bear in appearance. Its dark, shaggy hair, with white markings, makes a handsome fur. See WEASEL.

Scientific Name. The wolverine belongs to the family *Mustelidae*. It is *Gulo luscus*.

WOMBAT. A small marsupial (which see) found in southern Australia and in Tasmania. Anatomically, wombats are rather akin to



WOMBATS

Photo: Australian Trade Publsity

rodents, but in their habits and general appearance they are like miniature bears—the largest species is never more than 3 ft. in length. The legs are stumpy and there is practically no tail. They live in burrows and are vegetarian in diet.

Scientific Name. Wombats belong to the family *Phascolomyidae*.

WOOD, SIR HENRY (born 1869). Famous orchestral conductor. He was born in



SIR HENRY WOOD

Photo: Photopress

London. When only 10 years of age he acted as deputy organist at the church of St. Mary's, Aldermanbury, London, and from 1883 to 1886, gave organ recitals at the series of great exhibitions in London. He conducted the Carl Rosa Opera Company in 1891, and during Signor Lago's Italian Opera Season in 1893. Undoubtedly his great fame is largely due to the Promenade Concerts at the Queen's Hall, which he has conducted since their foundation in 1895.

WOOD, KINGSLEY, SIR (born 1881), English statesman. He qualified as a solicitor in 1903 and was elected to the London County Council in 1911. He has acted on many important committees. In 1918 he advocated the formation of a Ministry of Health. Since that year he has been Unionist member for Woolwich West. He was Postmaster-General from 1931 to 1935, when he was made Minister of Health. He is the author of various legal works.

WOOD. See TIMBER, TREE.

WOOD ALCOHOL, also known as Wood Spirit and Methyl Alcohol. A product of the distillation of hard wood. It is extensively used in industry, being a solvent of fats, gums, oils, and varnishes, and one of the raw materials used in the manufacture of formaldehyde (which see). It is also used to preserve anatomical specimens. Wood alcohol is a colourless liquid with a characteristic odour. It mixes with water in all proportions and boils at 149° F. Taken internally, it is poisonous, causing paralysis of the optic nerve.

A synthetic wood alcohol made by combining carbon-monoxide gas and hydrogen was produced by German chemists in 1924. It is known in the trade as *methanol*. See ALCOHOL.

Chemical Formula. The formula for wood alcohol is CH_3OH , that is, a molecule contains one atom of carbon and three atoms of hydrogen, and the hydroxyl group OH , the latter made up of one atom each of oxygen and hydrogen. These atoms remain unseparated in certain conditions.

WOOD CARVING. The art or process of cutting forms in wood, bearing the same relation to wood as does sculpture to stone. Wood carving was practised by some prehistoric peoples. The Egyptians were the first to practise it for decorative purposes, and in the early development of the plastic art, it occupied an important position. Low reliefs of animals or plants and graceful patterns of the lotus and palm seem to have been the subjects first elaborated. The earliest examples of the Greeks were crude wooden images of their gods, in many instances, they combined wood with marble. Roman ornament is a continuation of the Greek and Etruscan styles. The prows of Roman war vessels and galleys were carved with the heads of animals.

From the early years of the Christian Era, wood carving was employed extensively in the decoration of churches. The doorways of the wooden churches of Scandinavia and Denmark, dating from the ninth to the thirteenth century, are among the finest examples of early medieval wood carving. The fifteenth and sixteenth centuries were remarkable throughout all of Europe for



WOOD CARVING

1. Carving in Westminster Abbey depicting the Judgment of Solomon. 2. Fifteenth-century choir stalls, Santa Maria Nuova, Perugia. 3. Native idol from the north-west coast of New Guinea. 4. Native figure and bow! from the Sandwich Islands, now in the British Museum. 5. Statue of Shekh-al Balad, now in the Cairo Museum. 6. Wooden portrait figures of 1500 B.C. *Left*: a draped female figure. *Centre*: a scribe or officer. *Right*: a female figure. 7. Carved box of Te Rangihiaata, a New Zealand chieftain, now in the British Museum.

: Mansell; Fröh; Ahnari



WOODCOCK BREEDING

Photo: E. J. Hocking

the wood carvings used for ecclesiastical purposes. In the northern countries, shrines, altar-pieces and statuettes carved in wood were common, and these were often coloured and gilded. Elaborate stalls and screens were also carved for the churches, and carved furniture came into fashion in Italy and France. The wood carvings of Germany during this period were among the finest in the world; Nuremberg, especially, produced some of the greatest masterpieces of the art.

Wood carving to-day is practised with great skill in Switzerland and the Tyrol, while the Moslem carvers of Persia, Syria, and Egypt execute beautiful panels and other decorations.

The woods in general use are oak, walnut, lime, holly, pearwood, chestnut, and mahogany. Since so much of present-day ornamental woodwork is now made by machinery, the art has languished on a commercial basis, except in the countries named above.

WOODCOCK. A long-billed bird, related to but rather larger than the snipe (which see), and frequenting wooded country rather than open marshy regions. The woodcock is quite common in Britain and is found in the breeding season throughout Europe and Asia to Japan, and wintering in the Mediterranean regions, India and northern China. Related species are found in North and South America.

It has a mottled brown plumage. Its flight is characteristically hurried and irregular, except for that performed by the male during the nesting season. This flight is performed at dusk and is carried out in a regular beat and in a direct and unhurried manner. It is sometimes known as "Road-ing" or "Roding."

The long sensitive bill of the woodcock is used for probing in soft earth for worms and other insects which are its main food.

Scientific Name. The woodcock is *Scolopax rusticola*.

WOOD ENGRAVING. Designs cut in wood and employed in printing presses, like type, to reproduce in print the picture of the object engraved. The art of wood engraving

originated with the Chinese, but had an independent origin in Europe after the introduction of paper. The earliest print known dates from 1423. The art reached England in 1476, the year in which William Caxton (see CAXTON) produced a book printed from woodcuts. In book and periodical printing of to-day, metal designs have largely superseded wood.

Wood engravings are made on Turkish boxwood, the hardest variety of wood known, and the one which has the most regular grain. The work is done on the end of the grain, the wood being sawn crosswise.

The design which is to be produced is sometimes sketched on the smoothed block of wood, and sometimes it is photographed on it. The engraver then cuts out the pattern, forming it on the surface of the wood by means of raised lines and dots. That is, the design is left in projection, and the background is cut away or lowered. The ink, by which the pattern is transferred to the print paper, is applied to the projections, in contrast with the procedure in line engraving, in which the ink is applied to the grooves. An engraved wood block gives the printer a surface similar to that of a page of type. See ENGRAVING; PRINTING.

WOODPECKER. A very distinct group of birds which inhabit most of the wooded regions of the world, except Australia and Madagascar. As a whole they are brightly coloured birds, the hue varying greatly with the species, and they nest and obtain their food in trees. Their characteristic long and powerful chisel-like bill is used for



WOODPECKER

Photo: Cherry Kearton

digging into crevices in bark for the insects and larvae on which woodpeckers feed, and in the majority of cases for excavating, in dead or living tree-trunks, deep nesting holes.

The feet are large with two toes in front and two behind—except in the few three-toed species, in which there is only one toe behind, and the claws are strong and curved, making powerful anchors with which the birds cling to the bark of trees. The tail feathers are strong and stiff and make an extra support for the bird during its digging operations.

There are three species of woodpecker found in Britain. The green woodpecker is the largest. It is about the size of a turtle-dove. Its curious, rather harsh, laughing cry and the deep undulations of its short flights from tree to tree are unmistakable identification marks. In colour it is a uniform green with a deep scarlet crown.

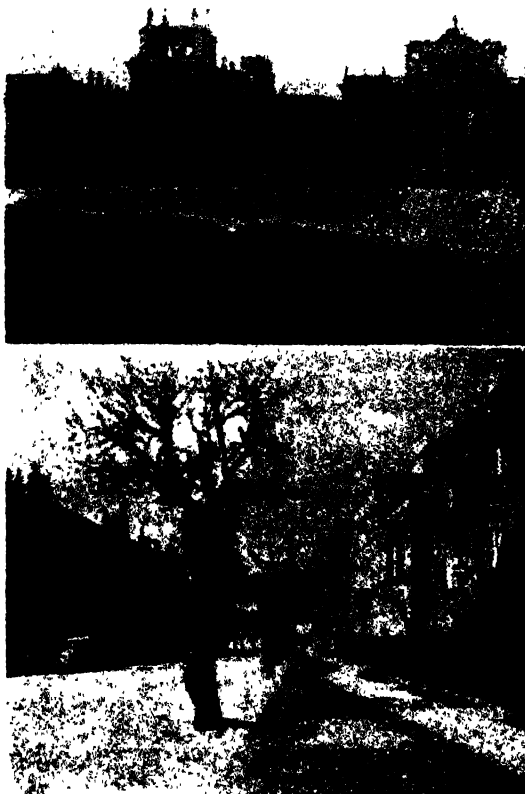
The other two species, the greater spotted or pied, and the lesser spotted or barred woodpeckers are more alike, the plumage in both being black and white in colour. The lesser spotted is smaller and the white markings on the upper side are in the form of bars. There is no red patch under the tail, but the male has a red crown, as in the greater spotted.

Scientific Names. The green woodpecker is *Picus viridis*; the greater spotted woodpecker is *Dryobates major*; the lesser spotted woodpecker is *D. minor*.

WOODSTOCK. A municipal borough of Oxfordshire, with an area of 157 acres and a population in 1931 of 1484. Commercially Woodstock is the centre of an agricultural district, but unique interest attaches to it owing to the proximity of Blenheim Palace and numerous old buildings in the town itself. The latter include a house which Oliver Cromwell occupied when staying at Woodstock, wherein Elizabethan windows have recently been uncovered. Another old house dated 1627 contains a fine Jacobean porch. The modern town hall is on the site of the old Market House, and markets for the disposal of local produce are still held in the open space in front of it. Blenheim Palace is the seat of the Dukes of Marlborough, being granted to John, first Duke of Marlborough, in recognition of his victories in the French wars, after the greatest of which it is named. The

Triumphal Arch was erected by Sarah, wife of the first Duke of Marlborough, in memory of her husband. The ornamental lake is laid out to represent the deploying of the troops at the Battle of Blenheim.

WOODVILLE FAMILY. The son of Richard Woodville, Lieutenant of Calais, was esquire to Henry V and governor of the Tower of London during the following reign.



WOODSTOCK

Above: Blenheim Palace. Below: Main street.

Photos: George Long; Taylor

In 1436 he married the widow of the Duke of Bedford, Jacquetta of Luxemburg. He fought in the French Wars and helped the Lancastrian cause in the Wars of the Roses, but on the fall of Henry VI in 1461 he changed his allegiance. Three years later Edward IV married Elizabeth Woodville and in 1466 Sir Richard was made an Earl and given the office of High Constable of England and Treasurer. At the battle of Edgecot (1469) Earl Rivers was captured and afterwards executed by the Lancastrians.

He was a man of cultured tastes and a strong supporter of the Renaissance. His son, Anthony Woodville, the second Earl, was a patron of Caxton and the translator of the first book (*Dictees and Sayings of the Philosophers*) printed in England. He was executed by Richard III on the day of his accession.

WOOF, OR WEFT. See **CLOTH**; also **WEAVING**.

WOOL. The modified hair that forms the coverings of domesticated sheep, certain species of goat, and a few other animals. The surface of a wool fibre consists of numerous tiny scales, which overlap one another like tiles on a roof. These all point in the same direction—toward the tip of the fibre—when on the animal. Wool fibres hold together firmly when spun into yarn, and are thus distinguished from hair, which has the same chemical composition. Wool also has a characteristic curl, or crimp, and the yarn does not come untwisted. These properties make wool an excellent fibre for cloth manufacture, and also for felt, which is a mass of matted wool and sometimes other fibres. Owing to the warmth and lightness of woollen textiles, sheep have been domesticated in almost every part of the world. Other animals reared for the same purpose include the alpaca and llama of South America; the angora goat of Asia Minor, which furnishes mohair; and the Cashmere goat of India, whose fibre gives Persian rugs and shawls their soft, silky texture.

Lamb's wool is the first shearing of the young sheep, taken when the lamb is eight to twelve months old.

Pulled wool is that removed from the pelts of slaughtered sheep.

The wool from pure-bred merinos has the highest quality of all fibres, but merino wool is sometimes shorter than is desired. Good results have followed the crossing of merinos with longer-woolled breeds (see **SHEEP**). Pure white is the most desirable colour in market fleeces.

Shearing and Manufacture. Ordinarily, sheep are sheared once a year, but in hot countries there may be two cuttings. While old-fashioned hand clippers are still used on small farms, on practically all large farms or ranches the work is done with machinery operated by petrol or electricity. As far as possible, the fleeces are removed in one piece. Scouring is necessary to cleanse the fleece thoroughly of dirt and grease. Ordinarily, the wool is passed through three or four vats containing warm water and soap, being stirred, while in the liquid, by automatic rakes.

After being dried, the wool undergoes a blending process, by which various qualities

are secured through the mixing of different fibres. The wool is then oiled to restore its natural pliancy, and is run through a series of carding machines. These are cylinders studded with teeth, which straighten and interblend the fibres, finally casting them out in the form of a continuous, flat band. The drawing machine reduces the band to a soft, loose cord called *roving*. After being wound on spools, the roving is spun into yarn.

Great Britain and the United States are the leading nations in the manufacture of wool products.

WORCESTER. County town, cathedral city and market town of Worcestershire,



WORCESTER CATHEDRAL

Photo: Frith

with an area of 3662 acres and a population in 1931 of 50,497, situated on the left bank of the Severn. The town was founded by the Saxons, from which period Worcester has been a cathedral city, although the earliest part of the cathedral which survives is the crypt, of early Norman construction, and the greater part of the fabric belongs to the Early English and Decorated periods of Gothic architecture. The castle which was a Royalist garrison during the Civil Wars has entirely disappeared. After the Conquest the town enjoyed great prosperity and was given the privilege of a mint by William the Conqueror. This privilege was retained until the reign of Charles I.

One of the most interesting modern buildings is the Guildhall—a fine example of Queen Anne workmanship. Particularly owing to the excellent railway facilities of the town, industry is becoming increasingly well represented. Here is manufactured the world-famous Worcester sauce. There are several factories manufacturing gloves. The porcelain industry is of historic as well as

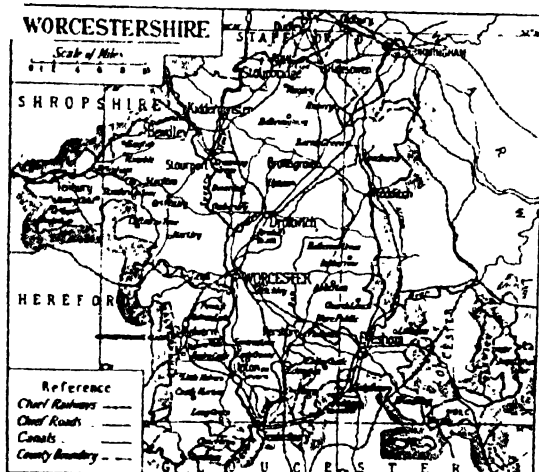
present-day importance. Large motor and other engineering works have been established. Chocolates and many varieties of foodstuffs are produced in addition to a large number of other manufactured goods connected with the hardware, clothing and furniture industries. A weekly cattle-market is held and a fruit market twice weekly. The annual horse fair attracts a large number of entries from the horse-rearing districts of the Severn valley.

WORCESTERSHIRE. A westerly inland county of England, bounded on the north by Shropshire and Staffordshire, on the south by Gloucestershire, on the east by Warwickshire, and on the west by Herefordshire, with an area of 447,678 acres and a population in 1931 of 420,156.

Physical Features. The greater part of the county is a fertile, undulating plain, watered by the Severn and the Teme and almost surrounded by hills. On the west the abrupt range of the Malvern Hills extends from the south-western corner northwards to Malvern and thereafter as a less well-defined range continues into the north-western part of the county where it forms a watershed between the Teme and the Severn. The whole ridge is marked by a steep escarpment on the east and west with a rounded grassy summit from which there is an uninterrupted view over the Worcestershire plain and into the Welsh Hills. The highest points are Worcestershire Beacon, 1395 ft., and Herefordshire Beacon, about 100 ft. less. Farther north, Wedbury Hill and Abberley Hill are of lesser elevation but better wooded. The highest point in this part of the range is Church Hill which exceeds 750 ft. where the hills merge into the densely wooded area of the Forest of Wyre. In the south-east of the county the northern escarpment of the Cotswolds impinges on the plain, offering as steep a fall to the valley as the Malvern Hills. Broadway Hill exceeds 1000 ft., whilst the isolated Bredon Hill, a disjointed spur of the Cotswold range, exceeds 950 ft. Here again the slopes are grass-covered, but diversified with many large coppices of coniferous trees and beeches. On the west are the Lickey Hills and the Clent Hills with a southern extension dividing the county from Warwickshire and giving some of the most attractive and most thickly wooded hill country in Worcestershire.

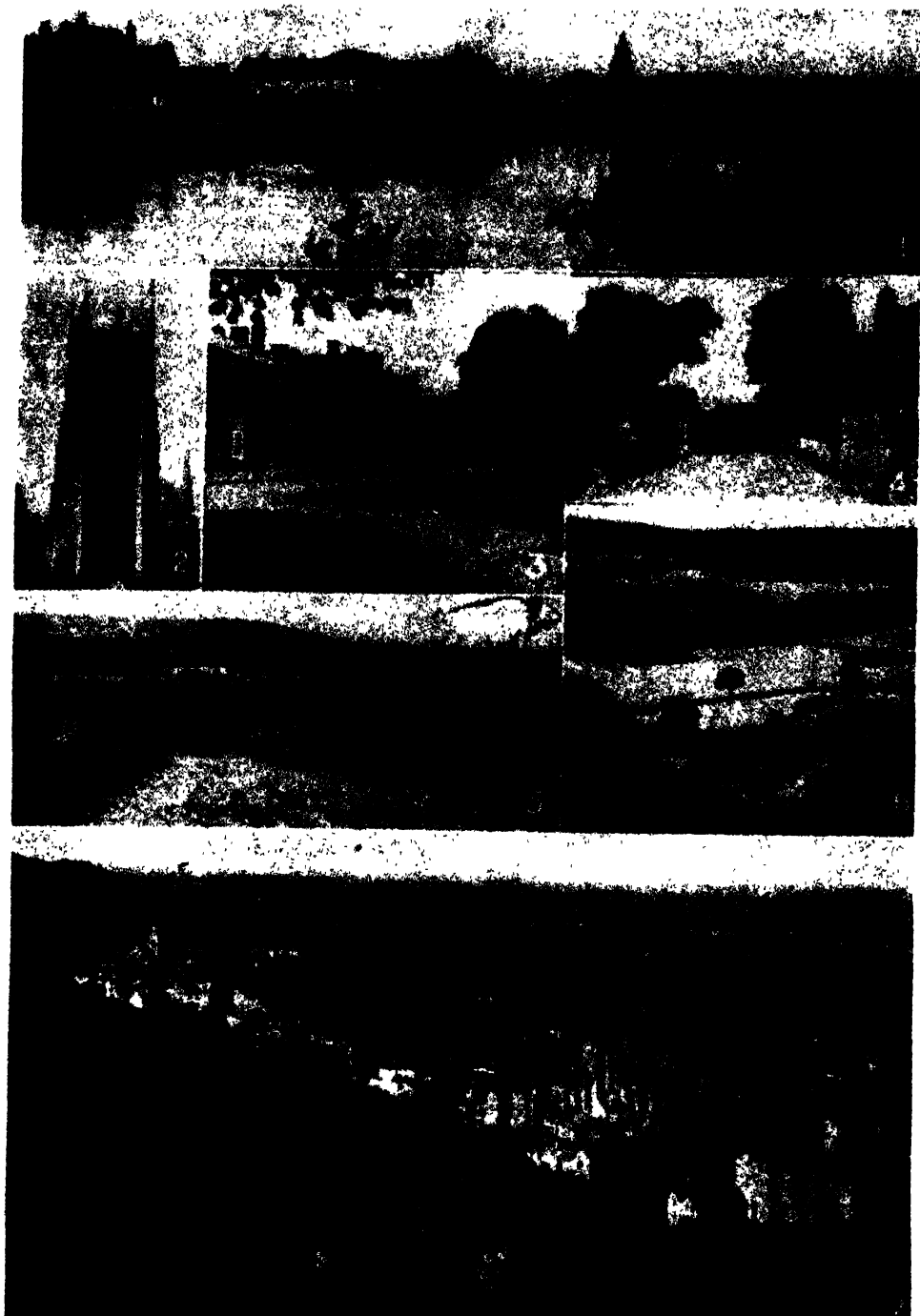
The central plain, which appears to an observer on any of the surrounding hills as

entirely level, is in fact a well-watered, well-wooded, extremely fertile agricultural country broken up by a number of minor elevations which give it a pleasantly undulating character. In the west particularly, the areas of woodland are extensive and represent all that remains of the medieval Malvern Chase. The most important river is the Severn, which flows in a general southerly direction, entering the county near Arley and passing through Stourport and Worcester before leaving the county near Tewkesbury. Its tributary, the Teme, enters in the west near Tenbury and flows east,



then south-east to empty itself in the Severn near Worcester. The Avon flows through Evesham and Pershore, entering the Severn near Tewkesbury after forming the county boundary for some miles.

History. The history of Worcestershire in prehistoric times was determined by the fact that the greater part of the county was covered, like the Sussex Weald, by an impenetrable forest so that traces of prehistoric man are confined to the surrounding hills (see *Antiquities*). The same influence may have been responsible for the comparative absence of signs of Roman occupation, although Worcester and Droitwich appear to have been stations of some minor importance. The Saxon period witnessed the growth of the town of Worcester, which became the See of a bishopric. The Norman Conquest passed without important or far-reaching incidents. In fact, the greater part of the county remained in Saxon control, both the bishopric of Worcester and the Abbey of Pershore (which was one of the largest and wealthiest of the abbeys of the west) continuing under Saxon ecclesiastics.



WORCESTERSHIRE

1. Upton-on-Severn. 2. Bell Tower at Evesham. 3. Broadway village. 4. Crophorne village.
5. Plum orchards near Evesham; Hredon Hill is in the distance. 6. View from Kinver Edge. 7. Malvern and the Worcestershire Plain from Beacon Hill.

Frisk; Taylor

Several important events took place in later centuries. At the Battle of Evesham in 1266 the Barons' War was finally decided. The county came within the Welsh Marches and was often subject to invasions from Wales, particularly by Owen Glendower who sacked Worcester at the beginning of the fifteenth century. In the Civil War the county was conspicuous for its loyalty to the King, and Worcester was one of the last garrisons to surrender. In 1651 at the Battle of Worcester Cromwell finally triumphed.

The cloth trade brought increased prosperity in the sixteenth and seventeenth centuries. Modern industry has been introduced in several towns (see below). The county is at present represented in Parliament by four members returned by the Bewdley, Evesham, Kidderminster and Stourbridge divisions.

Antiquities. The discovery of prehistoric antiquities has been confined to the high land, except for a number of bronze implements which have been excavated in the valleys of the Avon and Severn. Hill-top fortresses, generally ascribed to the later Iron Age, occur on Herefordshire Beacon, Wedbury Hill, Berrow Hill, Bredon Hill, and less well-defined on certain of the hill-tops in the Clent and Lickey district. The camp on Herefordshire Beacon is one of the largest and most elaborate of the promontory type of fortress and contains triple lines of banks and ditches. It appears to have been occupied by Romans and Saxons after being deserted at the beginning of the Roman occupation. Traces of the Roman period are confined to the discovery of coins, pottery, etc., many of which are at present in the Worcester Museum and were derived from the Worcester and Droitwich districts. In excavations at Droitwich mosaic pavements were also unearthed and point to some permanent occupation of this site. The Fosse Way, an important line of Roman communication, passed near the southern edge of the county.

The principal Saxon antiquity is in Tredington Church, where part of the Saxon nave remains. There is also a well-known Saxon cross at Cropthorne and traces of Saxon workmanship in Tenbury Church. From the beginning of the eleventh century onwards traces are much more numerous, more than thirty churches being recorded which show Norman architecture. Among the most notable of these are Blockley and White Ladies Aston church where the ground plan of the Norman church is still complete. Monastic ruins are relatively few, there being only parts of five remaining, all of Benedictine houses. Of these Evesham was of pre-Conquest foundation, but only

the tower of the post-Conquest abbey church survives. At Malvern the priory church is in use as a parish church and a single gateway remains of the monastic building. Similarly, at Little Malvern a part of the church has remained in continual use. The choir of the abbey church at Pershore and the exceptionally fine monastic building and cloisters of Worcester complete the number.

Industries and Manufactures. Agriculture remains the staple industry of the central plain of Worcestershire. Arable land is gradually giving way to pasture, and large herds of cattle are to be found throughout the course of the Severn valley. Stock raising and dairy farming are both carried on, the latter being specially localized in the country surrounding the larger towns, particularly Worcester. On the higher ground wheat, oats and barley are raised successfully, but the acreage under wheat is steadily diminishing. The Vale of Evesham has long been famous for its orchards and market gardening activities, and many square miles in the Pershore district are covered with plum, apple and cherry orchards. In this district cider making has arisen as an offshoot of the fruit growing industry. In the south-west a large but diminishing acreage is under hops, which are raised for the local breweries established in most of the larger towns. Historically the cloth weaving industry is of prime importance, Worcester, Kidderminster, Droitwich all having been large centres. As in other parts of the country, this has declined, and to-day the iron and steel industry, with its attendant minor manufactures, gives employment to a greater number than does agriculture. This industry is largely centred in the south, where there are prolific coal measures and where the industry descended from the Middle Ages when the afforested nature of the county gave abundant fuel before the working of coal. Agricultural machinery is the most valuable product.

The glass industry is centred at Stourbridge, the china industry at Worcester, the latter having supplanted the cloth industry towards the end of the eighteenth century. Glove making also flourishes at Worcester, whilst Kidderminster and Stourbridge have won a high reputation for the quality of their carpets. Finally, the salt industry at Droitwich is of historical importance, and survived until recently.

Principal Towns. The county town is Worcester (which see). The county borough of Dudley, and the municipal boroughs of Evesham, Kidderminster, and the urban district of Malvern, will also be found in their alphabetical positions.

Bewdley. A municipal borough, area 2105 acres, population in 1931, 4268, situated in the north-west of the county on the Severn. It is an important market town and owed its prosperity in the Middle Ages to the bridge which it commanded over the Severn. It was also important as a link in the considerable commercial river traffic. To-day the number of timber-framed houses recalls its medieval wealth. Recently it has become a dormitory for the larger town of Kidderminster.

Droitwich. A municipal borough, area 1856 acres, population in 1931, 4553, situated in the central plain on a small tributary of the Severn. Of Roman foundation, it has been engaged in the salt industry since Roman or early Saxon times and is mentioned in that connection in the Domesday Survey. Later it was connected by a canal with the Severn and with the Birmingham and Worcester canal.

Sloughbridge. A municipal borough, area 1920 acres, population in 1931, 33,225, situated in the extreme north-east of the county in the centre of the industrial area. It is a market town of importance and is engaged in the coal and iron industries. The manufacture of glass has also long given employment to many. A feature of the town is a seventeenth-century house, Wollaston Hall, and the church, which is of ancient foundation but was rebuilt in the nineteenth century.

WORDSWORTH, WILLIAM (1770-1850) This famous English poet was born at Cockermouth in Cumberland and educated at the grammar school of Hawkshead and at St. John's College, Cambridge. In 1790 he went for a walking-tour in France and Italy and in 1791 he returned to France, where he fell in love with Annette Villon, a surgeon's daughter. A child was born to her but Wordsworth was unable to get back to her when the French Revolutionary government declared war on the rest of Europe. Wordsworth's reactions to the French Revolution were intimately described by him in his great autobiographical poem, "The Prelude." At first he welcomed the Revolution as the hope of the world. But later its "domestic carnage" depressed him and alienated his sympathies. At this critical period of his life he turned to Nature for relief from his suffering.

In 1795 he met Coleridge and under the influence of their "productive friendship" each of them wrote some of his greatest poetry. Wordsworth's contributions to their joint volume of poetry, *The Lyrical Ballads* (1798), far outnumber Coleridge's and are representative of his best and worst work. The "Idiot Boy" has unsoundable depths of

bathos, the "Lines written a few miles above Tintern Abbey" are unsurpassably sublime.

As Wordsworth himself explains in the critical essays added to the enlarged editions of the *Lyrical Ballads* of 1800 and 1802, he endeavoured to extend the domain of poetry and to use a selection of the words really used by men, while avoiding the use of conventional poetic diction. The *Lyrical Ballads* were, indeed, a condemnation of decadent classical traditions in poetry and a manifesto of the revival in poetry to which the name "Romantic Revival" has been given.

In 1799 Wordsworth returned from a short visit to Germany and settled with his sister at Grasmere.

In 1802 he married Mary Hutchinson of Penrith and, three years later, he finished the "Prelude," which however was not published till after his death. In 1807 he published "The Ode to Duty," "The Ode on the Intimations of Immortality," *Miscellaneous Sonnets*, *Sonnets dedicated to Liberty*, and "The White Doe of Rylstone."

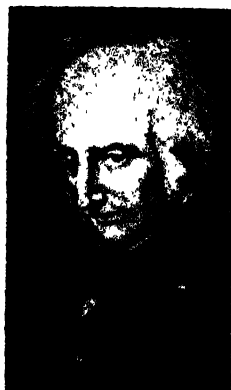
In 1814 he published his long poem called "The Excursion," and in 1822 the *Ecclesiastical Sonnets*. This list by no means includes all the numerous writings of Wordsworth. But it will be found to comprehend the best of his work if the following poems are added to it: "The Solitary Reaper," "To the Cuckoo" (1804), "I Wandered Lonely as a Cloud," and "Stanzas suggested by a Picture of Peel Castle."

Unlike the Augustan poets, Wordsworth gives a religious significance to the natural world and finds in it a "central peace subsisting at the heart of endless agitation."

In 1843, seven years before his death, he was appointed Southey's successor as Poet Laureate.

WORKINGTON. See CUMBERLAND.

WORKMEN'S COMPENSATION ACTS. A series of Acts of Parliament, beginning in 1897, the object of which is to make employers of labour liable to compensate their workmen for any "personal injury by accident arising out of and in the course of the employment." Under the Acts an employer is liable, even if the accident is due to the negligence of the workman. The



WORDSWORTH

injury must be such as to disable the workman from earning full wages for at least three days. Where the injury is fatal, the claim may be made by the workman's dependants. The scale of compensation is prescribed by law. The compensation in fatal cases is a lump sum not exceeding £600; in other cases it is a weekly payment, based on the workman's pre-accident earnings, but not exceeding 30s. a week. If the employer and the workman are unable to agree on any matter arising out of a claim to compensation the question is referred to arbitration. If the weekly payments have continued for six months, the employer has the option, at any time thereafter, to *redeem* the rest of his liability by the payment of a lump sum. See also EMPLOYERS' LIABILITY ACT.

WORLD WAR (1914-1918). **Political History.** The causes of the World War cannot be given in exact detail, but can be traced back to the division of Charlemagne's Empire (see *VIENNA, TREATY OF*) into the West Franks, East Franks and Lotharingia (or Lorraine). The descendants of the East and West Franks became respectively East Germany and France; dispute between them for the middle kingdom has recurred at intervals ever since. Louis XIV of France annexed Alsace-Lorraine. Germany took this territory after her victory in 1871, and an atmosphere of acute hostility existed between the two Powers thereafter. Bismarck formed friendly relations with Austria and Russia, but Russia came to feel that Germany's influence had checked her ambitions in the Balkans. This brought Austria and Germany more closely together and these two formed the Triple Alliance with Italy, who resented the French acquisition of Tunis. A natural consequence was that France and Russia should draw together.

Britain's Position. Britain had never committed herself deeply with any one nation, her alliances having been aimed at the preservation of the balance of power in Western Europe. At the close of the nineteenth century her official sympathies were with Germany rather than with France, and she suspected Russia of designs upon her Indian Empire. Her attitude was changed by Germany's vigorous colonial and naval programme which appeared to be too closely directed at her own interests. The result was the formation of the *Entente Cordiale* with France in 1904, and this developed into the *Triple Entente* with Russia. Thus Europe was divided into two armed camps and for the next ten years was constantly on the brink of war.

In 1905 Germany successfully claimed interests in Morocco; in 1908, after the Young Turks had ousted the old Turkish

regime, Austria seized Bosnia and Herzegovina and her action was supported by Germany; in 1911 Germany again interfered in Morocco, now demanding territorial interests, but France stood firm and was supported by Britain. Germany let the matter rest since she had not sufficient allies.

Sarajevo. On 28th June, 1914, the Archduke Francis Ferdinand, heir to the Austrian throne, was murdered at Sarajevo by Bosnian students. Austria accused Serbia of complicity; of this there is no proof, although the weapons used had originated in that country. (The Yugoslavian government has since 1929 erected a memorial to



ARREST OF PRINCIP AT SARAJEVO, JULY, 1914
Photo Topical

Princip, the actual murderer.) The Austrian demands, however, amounted to a surrender of Serbia's sovereign rights. Russia intervened, fearing the extension of Austrian interference in the Balkans. Germany and France supported their respective allies and by 31st August all four nations were at war.

Doubt as to Britain's Attitude. The Triple Entente was an agreement, not an alliance, and doubt as to Britain's attitude existed on the Continent. Germany did not expect England to enter hostilities, though warned that she might do so: civil war appeared imminent in Ireland, in England there were considerable labour troubles, instanced by numerous serious strikes, there was unrest also in India and in Egypt; maintenance of peace was one of the principal tenets of the Liberal Government then in office. On 2nd August Germany demanded free passage of her troops through Belgium and the Grand Duchy of Luxembourg, and on 4th August her troops crossed the frontier. By the Hague Conference of 1908 the Great Powers had pledged the neutrality of Belgium; further, Britain was traditionally opposed to the occupation of the Belgian coast by a strong military power. Britain

sent an immediate ultimatum to Germany. When midnight brought no answer the nations were at war. At the call to arms there was an immediate response, and from that time unswerving support was accorded the government at Westminster from every corner of the Empire. Troops, finance and every possible form of assistance were furnished most fully.

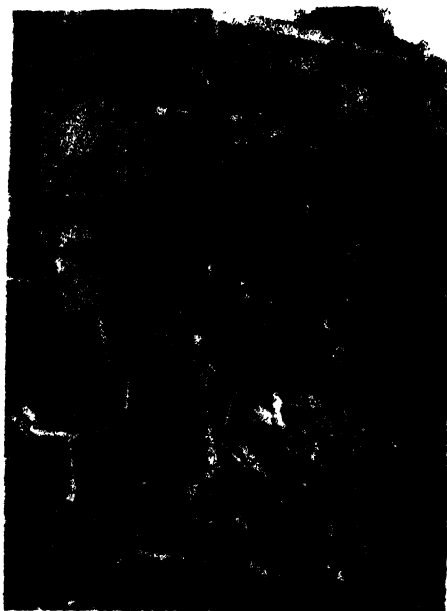
Before the end of 1914 both Japan and Portugal had joined the allies of Britain.

After the outbreak of the war party strife in Britain had practically ceased; the

The Central Powers were successful in their bid for the support of Bulgaria. At the end of the year (October) Turkey also joined them. Enver Pasha had been military attaché in Berlin, the Young Turks were strongly anti-British, and they looked favourably on the completion of the Baghdad Railway by Germany. Italy, where public opinion had long been hostile to Austria, had declared in 1914 that the terms of the Triple Alliance did not force her to enter a war in which she had no personal interest and of which she had no warning. On 26th April, 1915, she concluded with the Allies the secret Treaty of London, by which she promised intervention in return for territorial gains. She declared war on Austria in May.

The Problem of Man-power became increasingly grave, despite the fine response to Lord Kitchener's appeal for men, and numerous attempts were made to stimulate voluntary recruiting, the last of these being that of Lord Derby in 1915. Women took over many jobs in industry to release men for the fighting forces. Conscription was introduced in 1916. One remarkable feature of the war was the temporary reversal of a number of national habits. Britain, which had fought previous contests with a small professional army and had shown an often unbalanced enthusiasm for personal liberty, acquiesced cheerfully in conscription, censorship of the Press, and the numerous harassing restrictions of the Defence of the Realm Act. The entry of Rumania on the side of the Allies resulted in her swift defeat and threw open her oil and corn lands to the Central Powers. At the end of the year much dissatisfaction with the conduct of the war, loudly voiced in certain sections of the Press, led to the resignation of Mr Asquith and Sir Edward Grey. A new Coalition was formed with Lloyd George as Premier; he also presided over the War Cabinet of five, the other members being Bonar Law, Lord Curzon, Lord Milner and Arthur Henderson.

On 1st February, 1917, Germany reverted to unrestricted submarine warfare; this, and the discovery of German intrigues in Mexico, caused the United States to declare war on 6th April. By this time the loss of mercantile tonnage due to the submarine attacks had brought Britain dangerously near starvation and a strict system of rationing was instituted, Lord Rhondda becoming Food Controller. It had long been known in England that all was not well with Russia and a political *coup d'état* ended by placing power in the hands of the extremists. The Tsar abdicated and before the end of the year the Bolshevik government made peace with the Central Powers at Brest-Litovsk.



AFTER A ZEPPELIN RAID, 1916
Wrecked house at Stoke Newington, London
Photo: Central

parties sinking their differences in the interest of the conduct of the war.

In May, 1915, a Coalition government was formed with Asquith as Premier. In the following June a Ministry of Munitions was set up under Mr. Lloyd George. Throughout the year raids were made by Zeppelins with the primary object of damaging points of military importance, but the advantage of terrorizing the civil population was apparent and was more fully exploited by Germany later. A vigorous submarine campaign was also instituted by Germany, but this form of warfare was restricted in the interests of non-combatants, as the United States government protested strongly when Americans lost their lives in the sinking without warning of the liner *Lusitania* (7th May).

In this year aeroplane raids replaced the Zeppelin attacks which the defences had mastered in 1916. In London and other affected areas the population was badly shaken, but the national determination was not weakened, and by the summer of 1918 defence generally prevailed.

The German break-through of March, 1918 (rendered possible by the release of divisions from the collapsed Russian front), forced unity of command upon the Allies. Their long thin front could not be defended by a number of isolated commanders against attacks directed by a single brain. Sir Henry Wilson, Clemenceau, Poincaré, Haig, Foch and Petain met at Doullens on 26th March. Unity of command, mooted several times before by Lord Milner and others, was now agreed to be essential. Foch was appointed generalissimo.

Early in 1918 Lord Northcliffe was put in charge of propaganda which was carried out in enemy countries as well as at home, and this psychological offensive was partly responsible for the increase of war weariness in Central Europe and intensified the already serious effects of Britain's economic blockade of Germany. After the failure of the great German offensive of the spring and the refusal of their battle fleet to put to sea negotiations were instituted. On 9th November William II abdicated, and on 11th November Armistice was signed.

See VERSAILLES, TREATY OF; also CLEMENCEAU; LLOYD GEORGE; OXFORD AND ASQUITH.

The first months of the war saw threatened financial panic and a slightly hysterical epidemic of food hoarding, but these had been overlaid by a wave of genuine patriotic feeling which had caused the rapid formation of "Kitchener's Army." Throughout the war there were varying waves of exaltation (such as that caused by the false rumour of the arrival of Russian troops in England) or depression (such as followed the first grim reports of Jutland). A permanent spy scare which prevailed did scanty justice to the efficiency of the British secret service. The growing war weariness, however, never sank to despair; the deepening hatred of the enemy (seldom seen in British history) expressed itself characteristically in ridicule. During these four years the temper of the nation remained admirably steady.

Military History. The events which culminated in early August, 1914, in the

outbreak of world-wide war found the British Empire ill-prepared on land for such a struggle. In efficiency, training and morale, the British land forces were second to none, in marksmanship they were infinitely superior to any Continental nation, but in numbers they were, as the Germans said, "contemptible."

The whole fighting forces of the Empire



OUTSIDE BUCKINGHAM PALACE. ARMISTICE DAY, 1918

Photo. Cen.

did not reach 750,000, half the Regular Army was distributed between India and distant colonies and protectorates, and the Territorial Force was 70,000 officers and men under strength. Nevertheless, the first two British Corps landed at Boulogne on the 9th August, just five days after the declaration of war, and moved up to their position N.W. of Maubeuge, on the left of the Fifth French Army.

Meanwhile offers of contingents and assistance poured in from all parts of the Empire. At home Lord Kitchener, one of the few to realize that this war was to be a matter of years and not weeks, pressed on with the raising of half a million men as "Kitchener's Army" to replace the small trained forces.

1914. In brief, the strategy of the Allies intended a strong attack by the French right, which would shatter the German left wing and gain time for the Russian masses to be mobilized and equipped. The German inroad through Belgium, combined with the unexpected rapidity with which fortresses fell before the heavy German artillery,

wrecked this plan and compelled France to transfer troops to protect her left.

In response to appeals for early assistance, Russia threw her unready troops into East Prussia to relieve the pressure. Such was the situation—changing the area of concentration of the British Expeditionary Force from a defensive flank to the main battle



FRENCH HEAVY GUN ON AN ARMoured TRAIN
Photo: Central

area—which met the British Commander-in-Chief.

On 22nd August, the two British Corps fought and checked vastly superior German forces at Mons, but their right flank was exposed by the retirement of the Fifth French Army and they were forced to fall back. After three days of long marches and little rest, General Smith-Dorrien ordered his II Corps to stand and fight at Le Cateau, and inflicted such a check on the Germans that the British retreat was less closely pressed. A new French army under General Maunoury had come up on the left of the British, now reinforced by III Corps, and the retreat was continued over the Marne and Petit Morin to a point some 20 miles S E of Paris. General von Kluck, commanding the German right wing, had orders to pass west of Paris, but thinking that he had destroyed the fighting value of both the British and Maunoury's Sixth Army, wheeled to his left to smash the Fifth French Army. In so doing, he exposed flank and rear to the army of Maunoury, now reinforced from the garrison of Paris by Marshal Joffre's orders.

The British retreat was ended and on 5th September the advance across the Petit Morin to the Marne began, the passage of the Marne was forced and the British continued their advance towards the Aisne, with the Germans streaming north and northwest along the whole front of the Allies' left.

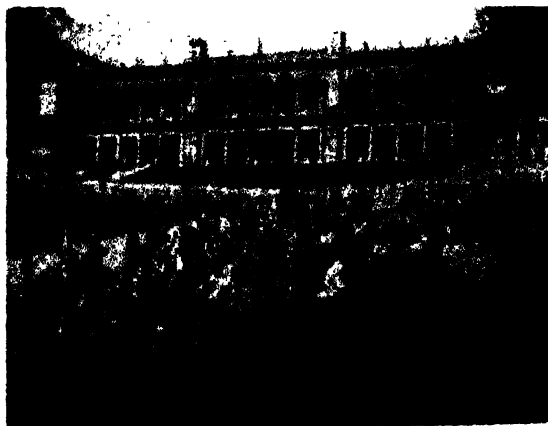
On the 7th September, however, Maubeuge had fallen and this enabled von Kluck

to be reinforced, the British were unable to secure a firm footing beyond the river, and the fighting on the Aisne died down. As both sides tried to outflank the other, the operations of Allies and Germans extended further and further north.

On 2nd October, the transfer of the British force to the left flank began in time to take part in the Battle of La Bassée; by this time the force under General Rawlinson, landed to relieve Antwerp, had fallen back on Ypres and gained touch with Allenby's cavalry. As the Belgians held from Ypres to the North Sea, the Allies and Germans were face to face along the whole front.

By 25th October, the Indian Corps was concentrated behind the II Corps and took part in the Battle for Neuve Chapelle; the Battles of Messines, Armentières and the long drawn-out struggle for Ypres followed, until trench warfare gripped the whole front.

With the advent of the new warfare, its barbed wire and trenches, the British found themselves short of machine guns and heavy artillery. Ammunition for artillery ran short, and without great expenditure of gun ammunition no attack could succeed in the face of machine gun fire. As the Germans were well supplied with heavy and field gun ammunition, the British casualties



PRISONERS OF WAR CAMP AT ALEXANDRA PALACE
Photo: Central

were out of all proportion to those suffered by the Germans even when in the trenches.

On 5th November war broke out with Turkey, and the Government of India dispatched troops of the 6th Indian Division to the Shatt-al-Arab. This expedition was undertaken to support the Sheikhs of Kuwait and Mohammedrah against the Turks, to protect British interests—especi-



WAR ON THE WESTERN FRONT—I

1. Interior of a shell factory. 2. Explosion of a mine. 3. Armoured car at Biefvillers, 25th August, 1918, during the Second Battle of the Somme. 4. Pack mules passing a wrecked artillery limber at St. Jean, 31st July, 1917, during the Battle of Plochem Ridge. 5. Wounded on stretchers at Ginchy, 12th September, 1916, waiting to be evacuated. 6. The first official photograph of a tank going into action at the Battle of Flers-Courcelette, 15th September, 1916. The man is wearing a leather tank helmet. 7. Men of the Border Regiment resting in a front-line trench at Thiepval Wood, August, 1916.

Photos: Imperial War Museum.

ally the oil fields—and as a counterblast to the declaration of a Jihad—Holy War—by the Turks.

The outstanding success which attended the early engagements of this force led to an ambitious attempt to defeat the Turks in this theatre of war and capture Baghdad. The Mesopotamian Expeditionary Force, as it was now known, won the battles of Qurna, Nasiriya, Amara and Ctesiphon, but was compelled to fall back on Kut, which was besieged by the Turks and surrendered in April, 1916. By 31st December, 1914, the Regular Army was much reduced in strength, the Territorial Army was in France, or had been sent overseas to release regular troops in Egypt and India, the reserves were exhausted and neither British nor French were able to undertake offensive action. The Germans were thus free to withdraw troops from the Western Front and strengthen their forces against Russia.

Russia appealed in turn for assistance, which could only be given by action against Turkey to free the Dardanelles, which it was believed could be achieved by a purely naval operation.

1915. In February, 1915, the Turks made their first attack on the Suez Canal, but were unsuccessful. After attempts to force the Dardanelles by purely naval action, military assistance was decided

upon and a combined force of 29th Division and Australian and New Zealand Army Corps landed on 25th April at Helles and north of Gaba Tepe. The landings gained a bare footing, and reinforcements hurried from Egypt failed to break through the Turkish defences, and a deadlock followed.

Meanwhile, on the Western Front the second Battle of Ypres opened on 20th April; in this battle the Northumberland Territorial Brigade was the first territorial formation to enter action as a brigade. Choked with gas and with their left flank uncovered by the withdrawal of the French, the gallantry of the Canadians foreshadowed the great deeds of the Canadian Corps in subsequent years. On 15th June, the Battle of Hoge gained little ground for the Allies. During July, the British force in France and Flanders was strengthened by divisions of Kitchener's Army, the complete Canadian Corps and the 27th and 28th Divisions of Regulars from overseas; by mid-September, sixteen Kitchener or New Army Divisions, had arrived and the Battle of Loos opened in September on the front of the First Army. Whilst this action was in preparation, a further attack on Gallipoli was planned and

divisions of the New Army landed at Suvla Bay. The operation failed on the threshold of success.

Our ally Serbia was now being overpowered by German and Austrian troops and assistance was sent from both France and Gallipoli, but arrived too late. The British troops had to be withdrawn hastily on the entry of Bulgaria into the war on the side of the Central Powers, and a combined force of British and French troops were virtually besieged in Salonika. Thus, by the end of October, a further campaign had been undertaken by the Allies and no real progress had been made.

From October to the end of December, the



FIGHTING BY LAKE VICTORIA

Colonel Driscoll (leader, during the Boer War, of the Driscoll Scouts) is standing in front of his men during the fight for Bukoba during the campaign in German East Africa. The machine gunner had just retired, having had his fingers blown off.

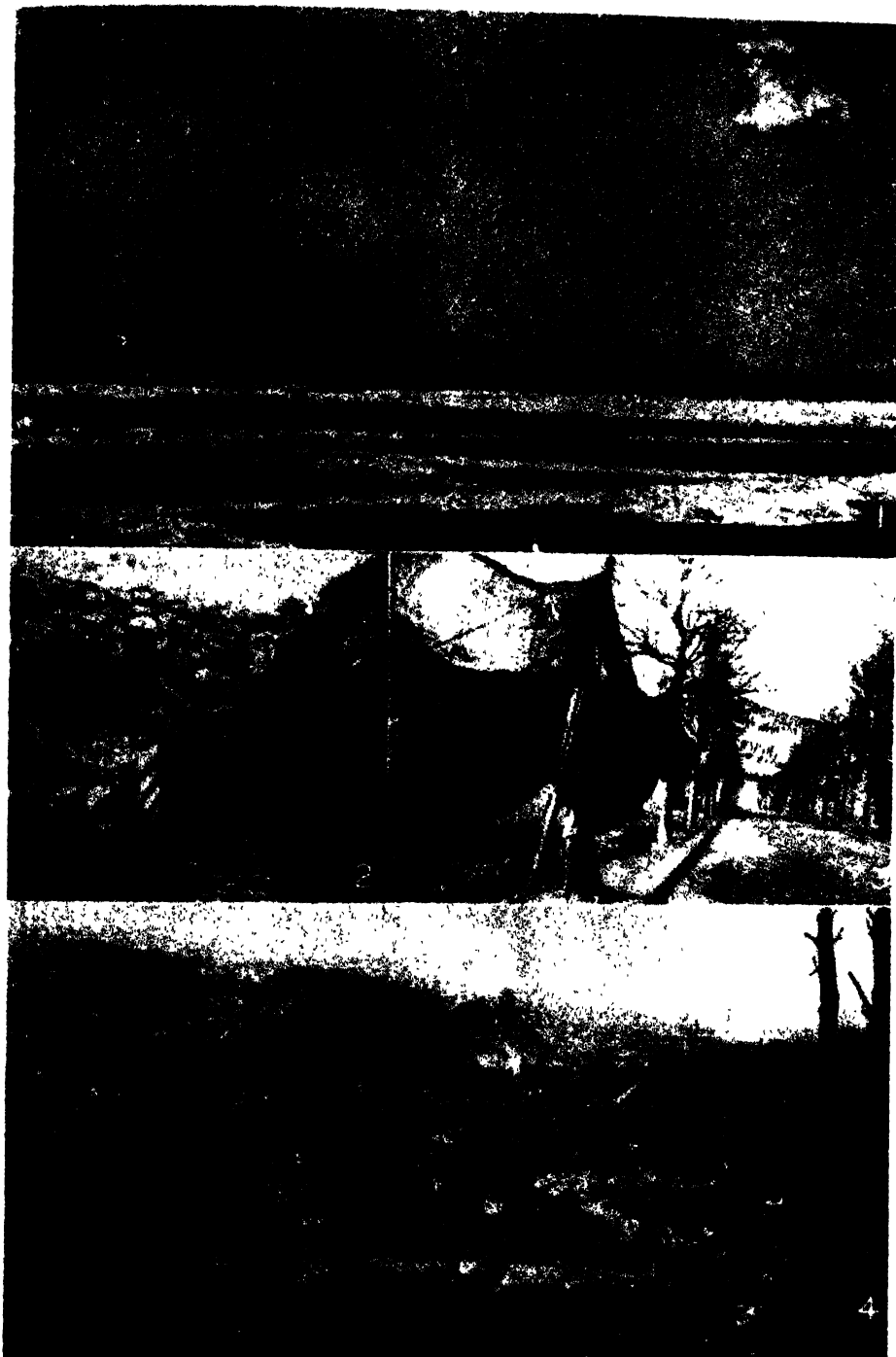
Photo: Cherry Kearton

British were engaged in the evacuation of Gallipoli, first in the withdrawal of troops from Suvla and Anzac, and at the end of December in the transfer to Egypt of the garrison of Cape Helles. Both hazardous operations were carried out without loss.

Egypt was now full of troops, war-worn and weary, but only requiring rest and training to refit them for active service. The defences of the Suez Canal were pushed out into the desert to prevent Turkish artillery from coming within range of the Canal, troops were trained and re-equipped and the bulk of the Australian and New Zealand infantry were transferred to France.

The Australian Light Horse and Yeomanry Divisions were re-formed and re-mounted and the Mediterranean Expeditionary Force was renamed the Egyptian Expeditionary Force, and took over the defence of the Suez Canal from General Maxwell, who was engaged with the Sudan and Senussi rebellions.

Rumania had entered the war with disastrous results to herself, and the Russian troops had been driven back. Russia herself, with the outlet for her corn through the Dardanelles still closed, was tottering, and the British troops in Mesopotamia, after



WAR ON THE WESTERN FRONT—2

1. British troops attacking near Mametz during the Battle of Albert, 1st July, 1916. Note the shrapnel shell bursting.
2. Men of the 22nd Infantry Battalion (French Canadians) draining a trench, July, 1916.
3. Putting up camouflage to shield a road near the line at Cambrin, 13th March, 1918.
4. The ruined village of Beaumont Hamel, November, 1916. The heap of ruins in the centre is the remains of the church.

winning the battle of Ctesiphon on 22nd November, had been compelled to withdraw to Kut.

1916. All British energies were devoted to preparations for the Battle of the Somme which began on the 1st July. The supply of ammunition, heavy guns and machine guns was now adequate, and the new tactics of crushing the enemy front line by a long and heavy bombardment could be tried out. Astonishing success crowned the initial attacks, but it soon became obvious that such huge bombardments destroyed the surface of the ground and gave the enemy time to reorganize his defences.

To ensure that no trenches or machine gun posts escaped, a wall of fire, known as a barrage, was put down in front of the advancing infantry and moved forward as the attack progressed. The heavy bombardments produced deep dugouts for shelter, trench mortars and hand grenades became of more importance than rifles, and countermining and mining took the troops further under ground.

In Mesopotamia, Kut had fallen in April, in spite of gallant efforts at relief, and the expeditionary force in this theatre needed heavy reinforcements.

The Battle of the Somme exhausted Allies and Germans alike, but a new offensive began on the Ancre on 13th November, ground was gained at first, but operations soon came to a standstill in mud.

In Palestine, throughout July, Kress von Kressenstein, the German commander with the Turks, was advancing through northern Sinai to attack the British at Romani, a fortified position covering the British railway, which was being pushed forward towards El Arish. He waited until August for his heavy artillery before making his attack, which failed and was caught in flank and rear by mounted troops sent forward from Kantara.

The British infantry, still weak from Gallipoli, were outmarched by the Turks, who used the trench lines dug during their advance to check the British mounted troops and withdrew with all their heavy artillery.

1917. On 24th February, the reorganized British force in Mesopotamia under General Maude captured Kut and almost destroyed the Turkish army opposed to him. The pursuit was relentlessly carried out and Baghdad was captured on 11th March.

In April, the United States entered the war and once more the balance of man-power seemed to swing in favour of the Allies. The highly successful though unspectacular operations of Arras and Vimy in April forced the Germans to devastate and abandon a large

portion of the Somme front to shorten their line.

In Palestine the British, after minor successes at Rafa and Magdhaba, had been checked in the First and Second Battles of Gaza, and General Allenby was sent to take over command.

The Third Battle of Ypres was undertaken on 31st July, at the urgent request of the French, exhausted by the terrible losses during the attacks on Verdun and faced with mutiny amongst some of their troops.

The fighting at Ypres resulted at first in large captures of guns and prisoners and eased the defence of the Salient, but it slackened when the weather broke and died in



AFTER REVOLUTION IN BERLIN, DECEMBER, 1918
German sailors taking up guard of the palace

Photo Topical

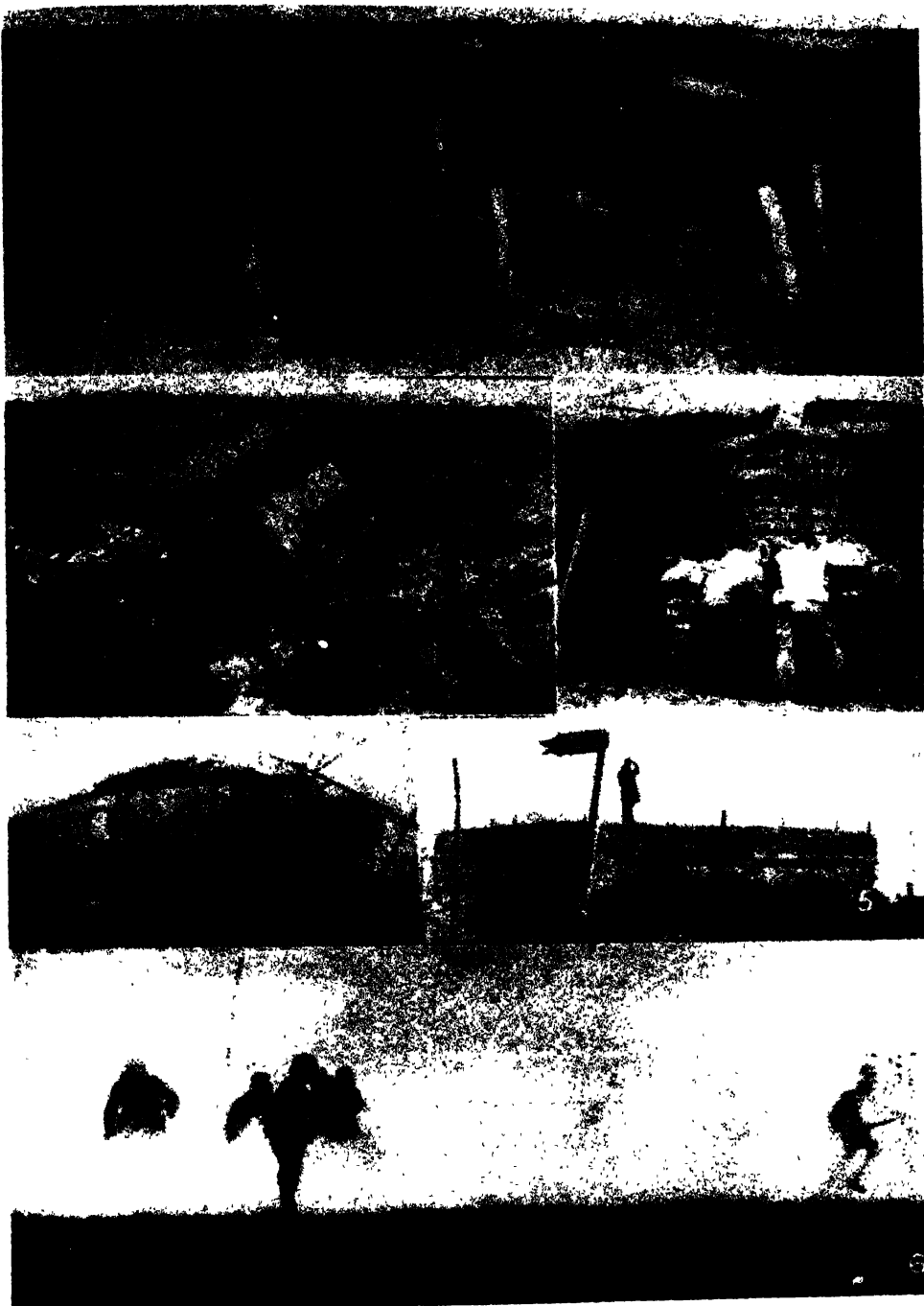
the mud at Passchendaele, having exhausted the British reserves. The Germans were now able to strip their eastern front of troops and collect reserves in the west for an offensive in 1918, before the American Army could take the field.

At the end of September Allenby was ready for his offensive in Palestine. He captured Beersheba, Gaza and Junction Station, but the rains came exceptionally early and his force was checked just short of Jerusalem, which did not fall until 9th December.

1918. The British Fifth Army had taken over about 20 miles of front from the French who were convinced that the German spring offensive would be directed against them, in spite of the urgent and confident reports of the British intelligence that it would fall upon the front of the Fifth Army.

This army had an extended front and few reserves; British man-power was falling rapidly; the Americans were arriving, but were not yet fit to take the field.

On 21st March the German offensive began against the Fifth Army.



LATE PHASES OF THE WAR

1. German barbed wire defences in the Hindenburg Line at Quéant, which was captured 3rd September, 1918. 2. A concreted trench and fire step over a dug-out entrance in the main Hindenburg Line near Bonz. 3. Fixing cylinders in position before a German gas attack. Note the discharge pipes leading over the parapet. 4. Tank going through barbed wire at Wailly, 21st October, 1917. 5. German concrete machine-gun post in the Quéant Line, Noreuil, 18th October, 1918. 6. German troops attacking, supported by a gas cloud.

Photos Imperial War Museum



SOME BRITISH NAVAL OFFICERS OF THE WORLD WAR
National Portrait Gallery

It broke right through, swept aside British and French reinforcements and almost reached Paris. The Germans relied upon new tactics, known as infiltration. Small bodies worked forward with machine guns and enfiladed one position after another. On 12th June, the final battle of the German offensive began at Villers Cotterets south-east of Paris, and the German advance was finally stemmed. All but one British Division in Palestine was called upon to send its infantry to France to help to check the German attack. Hardly had this attack been checked, when a further German offensive began further north near Albert, to be followed by one in the Ypres sector, which drove the Portuguese and British back past Kemmel, the nearest point to the Channel Ports reached by the Central Powers.

Such a series of disasters led to the appointment of a Generalissimo, at the request of General Haig. General Foch was appointed to the supreme command, and the system of short sharp attacks led by tanks, and known as "limited objective attacks" was instituted. A limited objective attack meant that the operation was stopped, immediately the progress of the infantry was checked. This removed the necessity for a pause to move the guns forward, the enemy was at once attacked on another portion of the front, and the action was again broken off as soon as it failed to get on.

Foch's counterstroke started on the 18th July, and gained immediate success. As soon as one attack slowed down, another in a distant sector of the line was started.

The American Army was allotted the task

of removing the St. Mihiel Salient south-east of Verdun, and drove the Germans back, capturing guns and prisoners.

The Battles of Cambrai, 1918, St. Quentin, Kemmel, Béthune, Scherpenberg, Drocourt-Quéant, Selle, Sambre, and the breaking of the Hindenburg Line, followed in quick succession and gave the Central Powers no breathing space. In Italy, Italian, British and French troops defeated the Austro-German armies at the Battle of the Piave and the Italians completed the rout at Vittorio Veneto.

In Palestine, General Allenby inflicted a crushing blow on the Turks at Megiddo, capturing the Turkish armies south of Deraa. Lawrence's Arabs destroyed the Turkish railway at this point and entered Damascus with Allenby's cavalry and Australian Light Horse.

The Allied Forces at Salonika assumed the offensive, defeated the Bulgarians at the Battle of the Struma, forcing Bulgaria to sue for peace, whilst Allenby pressed on after the Turks and captured Aleppo. Austria deserted Germany and asked for an armistice; the Germans were driven back all along the line, and by the 11th November, 1918, when the armistice came into force, British troops had reached Le Cateau.

From August, 1914, to June, 1916, voluntary enlistment had furnished over 5,000,000 officers and men for the British Army, from Great Britain alone, and it was not until 8th June, 1916, that conscription was introduced.

Naval History. The outbreak of the War found the navies of the Central Powers, generally speaking, in a position of disadvantage, both strategically and in point of

numbers, although against this must be set the extremely high quality of the German material. As a glance at a world map will show, Germany, though well placed to dominate the Baltic, has her access to the outer seas blocked by the land mass of England and Scotland, save through the narrow defile of the Dover Straits and the 140 mile wide passage between Scotland and Norway. The position of Austria was even worse. With all their bases on the shores of the Adriatic, her ships were compelled to pass through the narrow Straits of Otranto to enter the Mediterranean and again through the restricted sea-ways between Italy and the French North African coast if they were to operate to the westward. Finally their egress from the Middle Sea was made hazardous if not impossible by the British control of the Suez Canal and her dominant position at Gibraltar. In the Oceans, the Allies' numerous overseas possessions with their convenient harbours conferred upon them an advantage which became progressively more marked as, on the one hand, they were joined by other Powers and, on the other, Germany's colonies succumbed one by one to her enemies' arms. Only Russia of all the Allies was really badly placed. By the Agreement of 1851 her Black Sea Fleet—nearly half her navy—was denied egress from that sea; and when

Turkey, which controlled the Bosphorus, came into the war against her, its isolation was complete. Her Baltic squadron was almost as badly placed, as the Germans virtually controlled the Kattegat, and so could prevent it joining forces with its Allies. On the other hand, the Kiel Canal enabled Germany to move her ships between North Sea and Baltic with comparative ease. Russia was thus all but cut off from communication by sea with her Allies.

In ships the Allied forces enjoyed a preponderance which steadily extended, partly as the outcome of heavy ship-building programmes, but mainly as a result of the successive adherence of Japan, Italy and the United States to their cause. No such fortune favoured the Central Powers.

The war also witnessed the début of two new arms, the submarine and aircraft. Both were still in the development stage. Aircraft sustained a subsidiary but none the less very important role—the submarine came to play a part which nearly proved decisive, and fatal to the Allied cause.

The Opening Phases. The declaration of war found the British fleet, very fortunately, still largely undispersed after a test mobilization. The Grand Fleet moved north where, under Admiral Jellicoe, it took up its station at Scapa Flow in the Orkneys, with the



THE GERMAN BATTLE-CRUISER "SEYDLITZ" ON FIRE DURING THE BATTLE OF JUTLAND
At this time not only was she burning furiously but most of her guns were out of action, she had been torpedoed, and she was partly waterlogged. Nevertheless she was brought safely back to harbour and repaired.

Photo: Imperial War Mu

Battle Cruiser Force under Admiral Beatty at Rosyth. Both these bases were admirably situated strategically, but—particularly Scapa—lacked fixed defences. Light forces were stationed at Harwich and Dover; and the Second and Third Fleets, composed of older ships, were based on the Thames and Channel ports. The first result of these dispositions was to secure the passage of the Army to France, and on 28th August Admiral Beatty led a raid into the Heligoland Bight which resulted in the destruction of three German light cruisers.

In the Mediterranean the first task of the Allied fleets was to secure the passage of the French African Army to France. The position was complicated by the presence of the German battle-cruiser *Goeben* and light cruiser *Breslau* in Italian waters. Owing to a series of misunderstandings these ships were allowed to escape to Constantinople, where their presence was an important factor in bringing Turkey into the war on Germany's side.

In the oceans a number of German cruisers, notably the *Emden*, caused considerable damage to Allied trade, but by the end of 1914 they had all been destroyed or immobilized. On 1st November of that year the German China Squadron under Count von Spee destroyed Admiral Cradock's weaker cruiser force off Coronel, in Chile, only to be itself annihilated by Admiral Sturdee's battle-cruisers at the Battle of the Falklands on the 8th of the following month.

The North Sea. In view of the British preponderance, the German High Command decided to follow a policy of attrition, designed to equalize more nearly the strengths of the two fleets before offering battle. Their aim was to be accomplished by means of submarines and mines, the operations of the High Seas Fleet being confined to feints designed to induce the Grand Fleet to expose itself. Two such operations were the bombardments of Scarborough and Hartlepool during November and December, 1914, by the German battle-cruisers. A somewhat similar raid was attempted on 24th January, 1915, but on this occasion the German, under Hipper, were brought to action by Beatty at the Battle of the Dogger Bank and forced to retire with the loss of a large cruiser.

On 31st May the Battle of Jutland was fought, the only occasion when the two main fleets were to become engaged. Scheer, the German Commander-in-Chief, had planned a sweep into the Skagerrak. Jellicoe, apprised by the Intelligence of his movements, put to sea in the hope of intercepting him. The actual meeting of the

two fleets took place in the afternoon, and was entirely fortuitous. The action falls broadly into three phases. In the first—the battle-cruiser action—the Germans undoubtedly had the advantage. In the second, when the battle fleets became engaged, the Germans found that Jellicoe had placed them in a position of grave tactical disadvantage from which they were extricated partly by Scheer's resolute leadership, but largely as a result of failing visibility due to mist and the onset of darkness. During this phase they suffered severe punishment. In the third—the night—phase the Germans contrived to pass astern of the Grand Fleet, which had been placed between them and



FUNNEL OF H.M.S. "VINDICTIVE" AFTER THE ZEEBRUGGE RAID, APRIL, 1918

Photo: Topical

their bases, and gain the security of their own harbours.

Much controversy has raged, and will continue to rage, over this battle. Both sides claim a victory, and on the score of losses only the Germans are justified. But in their main object, to wrest the command of the sea from the Grand Fleet, they failed completely. The British navy remained in possession of the field, and to the end of the War it continued to control the surface of the sea except for a comparatively limited area adjacent to the German coast. Only once more, at the very end of the War, did the German naval command decide deliberately to seek battle, and then their seamen mutinied.

The following August Scheer endeavoured to lead the Grand Fleet into a trap composed of submarines working in conjunction with airships. The attempt miscarried, but nevertheless Jellicoe lost two light cruisers. In November, 1917, the light forces of the two fleets—the British now under Beatty—supported by a few heavy ships, engaged in an indecisive encounter. This was the last



WAR IN THE AIR AND ON THE SEA

1. Air fighting diagram issued by the Air Ministry for the guidance of flying officers in training. 2. A British convoy steering a zig-zag course in the danger zone. The convoy system proved to be the answer to the German submarine campaign. 3. At the Battle of Jutland, 31st May, 1916. On the right, H.M.S. *Queen Mary* blowing up. On the left H.M.S. *Lion* with German shells falling round her.

Photos: Imperial War Museum; Central.

occasion on which capital ships were to be in action. Engagements between light craft and submarines continued, however, and on St. George's day, 1918, Admiral Keyes launched his brilliant attempt to sink blockships in the canal entrance at Zeebrugge and so bar the egress of the submarines of the German Flanders Flotilla, which were wreaking terrible destruction on Allied shipping. A few days later he repeated the exploit at Ostend. All this time the moni-



SUBMARINE "U.35" TORPEDOING A MERCHANT SHIP

On this occasion the submarine is on the surface: usually such attacks were made submerged. U.35 was commanded by the celebrated submarine "ace," Lieut.-Com. von Arnould de la Perrière.

Photo, Imperial War Museum

tors working out of Dover had been affording useful support to the Army by harrying the German right flank and Flanders coast defences. In October came the mutiny in the German fleet which led to revolution in the country and the collapse of all resistance.

The Mediterranean. In this area the continuing problems were the security of the great trade route via Gibraltar and Suez to the East, and the French communications with North Africa. From the very outset the Austro-German forces were heavily outnumbered by the combined Franco-British strength, and with the advent of Italy, with her considerable fleet and Adriatic bases facing those of Austria, this preponderance became overwhelming. As a result, the heavy ships of the two sides never met in battle.

Early in 1915 it was decided to attempt to force the Dardanelles with a view to opening up a sorely needed line of communication with Russia, and also of crippling

Turkey and perhaps forcing her out of the war. The project was finely conceived, but its execution was faulty from the start. In the face of all previous experience, an attempt was first made (February, 1915) to force the Straits with the ships of Admiral de Robeck's Anglo-French squadron, unaided by troops. The effort failed, albeit by a narrow margin, and it was then decided to take the Gallipoli Peninsula with an army and thus secure the passage of the fleet into the Marmora. In April General Hamilton's force, covered by the guns of the fleet, most gallantly effected a landing, but in the months of bitter fighting which followed it was never able to make adequate headway, and in December of the same year it was withdrawn. Thanks to brilliant organization and the closest co-operation between land and sea forces, this most hazardous operation was effected without the loss of a man.

Other operations in which the navy and army worked together were in the defence of the Suez Canal, and in Palestine, where ships supported the left flank of Allenby's victorious army.

The Outer Seas. Apart from the business of hunting down German commerce destroyers and interrupting German and Austrian trade, the early days of the war found the Navy again collaborating with the Army in the reduction of the German colonies, a work in which the Allied forces, and particularly those of Japan, participated. Troops from the Dominions and India had to be convoyed to France and other theatres of war, and in the Mesopotamian campaign the Royal Navy and Royal Indian Marine took a considerable share in the riverine war which occupied a prominent place in those operations. As the submarine war against commerce developed, so increasing efforts to counter it had to be made. For the most part this campaign was conducted in waters comparatively adjacent to the coasts of Europe and northern Africa; but occasionally a submarine—or even an armed and disguised merchant vessel—made her way to the east coast of America or even farther afield, and did some amount of damage.

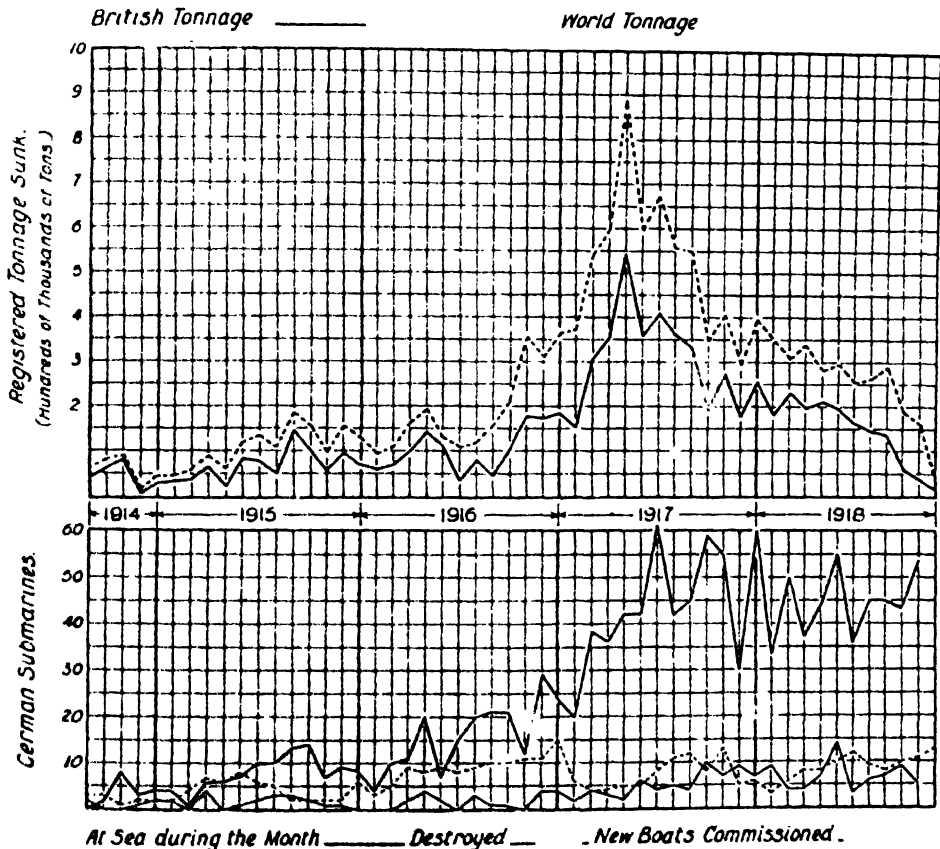
The operations in the Baltic and Black Sea call for little comment. The Russian navy had not yet recovered from its defeat at the hands of Japan, and was able to accomplish little; and with the Bolshevik revolution it passed finally out of the war.

The War against Commerce. By the end of 1914 the Allied fleets virtually controlled the great sea highways. In 1909, however, Britain had been a party to the Declaration of London, an instrument designed to regulate the conduct of war at sea. Although it

had not yet been ratified, Britain, on the outbreak of war, most ill-advisedly declared her adherence to it. By so doing she voluntarily threw away a great part of the advantage which her control of the sea conferred upon her, and left open avenues through which the Central Powers were able to import vast quantities of urgently needed supplies. The inexorable force of events then compelled the progressive abandonment of the terms of the Declaration, with the not unnatural result that considerable friction with neutrals ensued. By 1918, however, the blockade had been made really effective, and the privations it imposed on Germany and her allies did much to undermine their resistance and contributed in no small measure to their ultimate collapse.

On the German side it was soon perceived that the campaign of attrition was unlikely

to achieve its object: it was also realized how dependent the Allies—and particularly Britain—were on sea-borne supplies, and that if only this flow of imports could be even seriously interrupted, an Allied collapse would ensue. The weapon which the Germans chose as a means of destroying this trade was the submarine. Under the then existing rules of war, which required strict conditions to be satisfied before a merchant ship might be captured or sunk by a belligerent, and the safety of passengers and crew to be assured in the latter eventuality, submarines operating against commerce were placed at a considerable disadvantage as compared with surface ships. Germany therefore decided to operate her submarines in defiance of many of these rules, recognizing that by so doing she was bound to come into conflict with neutrals, but believing that



THE GERMAN CAMPAIGN AGAINST SEABORNE COMMERCE

The graphs in the upper chart show the destruction, month by month, of British and World tonnage and are based on figures given in *Seaborne Trade* (Fayle). The graphs in the lower chart show the numbers of German submarines operating, their losses, and replacements by new construction. They are based on figures given in *U-boat Service, 1914-1918* (Michelsen) as quoted in *The German Submarine War, 1914-1918* (Gibson and Prendergast).

she would achieve victory so quickly that any counter-measures they might initiate would not become effective until the Allied cause was hopelessly lost. The campaign began in February, 1915, and although, in deference to neutral protests, its rigours were somewhat curtailed at times it inflicted enormous and steadily mounting losses, as a glance at the annexed graphs will show. In February, 1917, Germany realized that the progress of the war called for a supreme effort, and she threw off all restraints. The tale of sinkings soared and the Allied situation became very nearly desperate: in fact at one time only three weeks' reserve of food remained in England. But by now the Allied counter-measures were maturing. At first, largely due to a lack of suitable vessels and weapons, they proved inadequate. But early in 1917 when, thanks in great measure to the entry of the United States into the war, a sufficiency of light craft became available for the purpose, the oft-tried device of *convoy* was revived. Under this system merchant vessels sailed in groups, escorted by warships, so that an attacking submarine was forced to accept the risk of counter-attack by the escorting vessels. By the middle of 1917 the system was in full swing, and the tale of losses fell rapidly; this despite a coincident and considerable increase in the number of submarines which the Germans were able to keep at sea. The German effort had failed, and just before the Armistice the submarine campaign was called off altogether.

The toll it had taken, however, was heavy; 15,000,000 gross tons of shipping had been sunk, of which 9,000,000 were British. Against this only 10,750,000 tons of new ships were built, so that even counting in 2,250,000 tons of enemy shipping captured, there remained a net loss of nearly 2,000,000 tons. On the German side, of the 572 submarines constructed, 178 were destroyed. Of these, 44 were sunk by mines, 38 by depth-charge attack, and 19 were torpedoed by Allied submarines.

The Armistice. With the termination of the submarine war against commerce came the collapse of the Central Powers. First Turkey, then Bulgaria and Austria succumbed, the Austrian fleet going over to the Yugoslavs who had seized the opportunity to assert their independence. Finally Germany herself asked for an armistice. By its terms she was compelled to surrender all her submarines, and to send the finest vessels of her High Seas Fleet to be interned at Scapa Flow. There they were scuttled by their own crews just as the Treaty of Versailles was being concluded. Similar terms were imposed on her allies. Under the Peace

Treaties the Austro-Hungarian navy disappeared altogether, and the German fleet was subjected to severe restrictions in numbers, tonnage and armament.

Aerial History. The war of 1914 is the sole repository of information about aerial warfare on a large scale and that information refers to two main branches of development, the development of the machine itself and the development of the method of using it. It will be convenient to treat these two branches separately, although obviously they are interconnected in practice.

At the beginning of the War the purely military conception of the functions of the flying machine prevailed. Royal Flying Corps aeroplanes were sent out on "scouting" duties. The pilot wore the "wings" badge, which has been used ever since to mark him, and the observer wore a single wing which merged at the root into an O.

Later on, however, when the real war in the air began, aerial fighting was introduced and grew with dreadful rapidity. Early records of the war contain many accounts of British and German aeroplanes meeting in mid-air and being unable to attack one another because they were unarmed. Revolvers were used in the attempt to bring the other machine down and, on one occasion, an officer attempted to take the offensive by throwing his field glasses at an enemy machine. Guns began to be mounted to shoot rearwards and over the top plane. The B.E. aeroplanes were equipped with Lewis guns which, although their radius of fire was limited, could be used both for attack and defence. Shots were exchanged but decisive results were exceptional.

Then came the Fokker single-seater fighter with the machine gun fixed to fire in the line of flight and with a device for preventing the bullets from damaging the airscrew blades. Actually the original method was to employ "deflectors" fitted to the airscrew blades. Later "interrupter" gears were invented to enable the gun to be stopped momentarily if the instant of fire would have coincided with the passage across the front of the muzzle of one of the airscrew blades.

Meanwhile British designers were working along a different line. And although this line proved eventually unsuccessful, it must still be regarded as highly ingenious. Instead of modifying the gun to suit the aeroplane, the British designers attempted to modify the aeroplane to suit the gun. They introduced, for military duties, the "pusher" machine, in which the engine was fitted behind the pilot and both pilot and gun were housed in a forward nacelle with an unobstructed outlook forwards. Lewis guns were used attached to swivelling mountings. A wind

vane foresight which automatically made allowances for the speed and direction of the machine was employed.

The various types of F.E. aeroplane, including the single-seater F.E.8, were pushers and so was the D.H.2. They proved effective machines in battle at first, but later it was discovered that performance in speed and climb outweighed in importance field of fire—the first big lesson in aerial tactics during the War.

Both the Allies and Germany now concentrated upon the tractor aeroplane in single-seater and in multi-seater form and the fixed, forward-firing gun became general. Aerial fighting then reached its most intensive period. Major Hawker, Captain Albert Ball, Captain McCudden, Major Mannock and Captain Bishop are names which will be remembered among the great air fighters. They were mostly lone fighters, who went out alone or acted alone with a patrol to protect them. They did not form units of a formation which acted together according to plan. But formation flying began with the great air fighters, and gradually their individual methods were superseded by group methods in attack and defence.

When it was found that performance was the supreme need for success in aerial combat, the designers and constructors were continuously pressed to give more and yet more performance. Engine powers began to rise. From 60 h.p. and 80 h.p. rotary engines, the powers rose to 100, 110, 130, 150 and 200. Engines capable of giving more than 200 h.p. were in production at the end of the War. And air-frame development had also been moving forward. The much-braced biplane, with wires running in all directions, such as the B.E. and the F.E., gave way to the Sopwith "One-and-a-half Strutter," the D.H.4—with Rolls-Royce engine—and the S.E.5 with Hispano Suiza engine. They were still braced biplanes and the British air service did not depart from this structural formula at any time during the War, but they were aerodynamically "cleaner" than previous types. Consequently they were faster and had a better rate of climb.

In the early days the military requirements from aeroplanes were modest enough. In the summer of 1912, for instance, the military trials held at Larkhill called for an endurance of at least 4½ hours, a speed of at least 55 m.p.h. and a climb of 1000 ft. in five minutes. As the war progressed

speeds rose to over 100 miles an hour and the rate of climb began to approach 1000 ft. a minute after the take-off. Manoeuvrability reached perhaps the highest peak it has ever reached. The Sopwith Camel, although it had far less speed than post-war service machines, was probably the quickest acting machine on the controls ever produced. It is worth recording also that both the Allies and the Germans tried the triplane formula and obtained a certain amount of success with it. The Fokker triplane was used by many of the great German air fighters, and



SHADOW OF ZEPPELIN AT POTTERS BAR, OCTOBER, 1916

Photo Topical

the Sopwith triplane was used by the Royal Naval Air Service.

Although one monoplane had shown excellent qualities, no British machines of this type were used in the squadrons at the front. The only monoplanes used by the Royal Flying Corps were the French Morane "Parasols" and Morane "Bullets." In view of subsequent developments, with the air services of almost every important air power going over to the monoplane for all types, this adherence to the biplane and triplane formula during the War may seem curious. But it is to be remembered that the retractable undercarriage, although it had been invented, had not reached the practical stage and that in consequence the monoplane with its thick wing in which there is room to house the retracted wheels and struts, did not show so marked an advantage over the biplane. Some of the biplanes were specially designed to give good outlook. The D.H.5 may be mentioned, and the Sopwith Dolphin. The D.H.5 had the two planes set at a pronounced backward stagger, with the result that, although the machine was a tractor, the pilot sat out in

front in much the way he would sit in a pusher, and enjoyed an almost uninterrupted view forwards. Mention must also be made of certain aeroplanes made for special duties. The Sopwith Salamander was an armoured machine designed for attack on ground targets. Over 600 lb. of armour was arranged round the pilot.

Concurrently with this progress in machine types there was the progress in tactics. The individual combat gave way to the formation combat. The Fokker, which had caused such trouble to the Allied forces when it appeared in the summer of 1915, was overcome by the spring of 1916. The Nieuport scout did much to turn the scales. Then, in 1916, the Royal Flying Corps was called upon to put forth a special effort in aid of the ground troops in the Battle of the Somme. The Germans were then using the Albatross and the Halberstadt and there were frequent battles between formations of six machines on each side.

It became the usual thing for British pilots to fly in formations of six or more. Sometimes a whole "wing" went out ranged

in layers at different heights. But the Germans introduced the famous "circus" system, a brilliant scheme for making the best use of the forces available and enabling any point on the front to be reinforced with fighting machines at a moment's notice. As a result British formations frequently found themselves vigorously challenged and occasionally out-fought. Richthofen's circus gained renown for its long list of victories. Against it the Royal Flying Corps put yet larger formations, and by April, 1917, it also introduced a new machine, the Bristol Fighter, a two-seater, with Rolls-Royce water-cooled engine, capable of good performance and high powers of manoeuvre.

At this time aeroplanes were being used for a steadily greater variety of duties. Army Co-operation, one of the first duties, was continued with greater vigour and so were reconnaissance and photography. And there were bombing, low flying attacks on ground targets; contact work with advancing infantry; attacks on observation balloons and on aerodromes; and "special missions" which were usually for landing



THE SIGNING OF THE VERSAILLES TREATY

Photo: Topical

spies in enemy territory. Formations grew and grew. One combat involved more than 100 aeroplanes and there were many combats involving twenty or thirty machines.

By the end of the War formations went out with precise instructions as to the part each unit was to play in attack or defence, and air fighting had progressed from the time when individuals engaged one another in combat with great heroism, but without any very clearly defined tactical method. The aeroplane had developed from a machine of observation to a machine of attack. See also AIR RAIDS.

WORMS, OR VERMES, ver' meez A term used in a popular sense for a wide variety of crawling, soft-bodied animals. In zoology, a distinction is drawn between true worms and the wormlike larvae, or young, of beetles, butterflies, and moths.

Worms are many-celled animals, lacking either a vertebral column or the more primitive supporting axis called *notochord*. They possess a distinct body cavity, but have no jointed appendages and no creeping foot. Among them are some of the parasites that infest man, including tapeworms, hookworms, roundworms, and the trichina. The most highly developed worms are the segmented forms, represented by the earthworms.

Worms range in size from microscopic forms to the tapeworms, which may be 30 ft. long. Among the most numerous of worms are the threadworms and hairworms, found in water, soil, and decaying organic matter. The known species number several thousand.

WORMS, vermes. See GERMANY.

WORMS, DIET OF. See LUTHER, MARTIN.

WORMWOOD. There are several aromatic plants of the composite family which bear this name, and many botanists use it as the common designation of an entire genus, *Artemisia*. The most important wormwood from a commercial standpoint is a perennial plant native to Europe and Northern Asia. This species yields an essential oil used in the manufacture of the French drink absinthe (which see), and in the preparation of a medicine to expel intestinal worms.

WORSTED, woos' ted. A thread or yarn spun from wool which has been combed to lay the fibres parallel. It is used for making carpets, cloth, hosiery, and for other industrial purposes. The term is also applied to cloth made from such yarn. It is derived from Worsted, or Worstead, in Norfolk, where the yarn was first made.

Straightness of fibre is an essential characteristic of worsted yarn. In order to obtain a *sliver* or *roving* of wool which can be spun into a satisfactory washed thread,

many operations are necessary; these include scouring, drying, "preparing," or *gilling* (five or six consecutive operations), backwashing, or re-scouring, to remove oil or dirt, straightening, combing, drawing, and spinning.

Several varieties of worsted twill fabrics are known as *serge* (which see). See also WOOL.

WORTHING. A municipal borough and watering-place of Sussex with an area of 7227 acres and a population of 46,230 in 1931, including within its boundaries the parishes of Goring and Durrington. Entirely modern in origin and growth, Worthing has few points of historic or architectural interest, but contains within its boundaries



OLD TOWN HALL, WORTHING
Photo: Fox

a notable prehistoric landmark in Cassbury Ring. Here is a Neolithic causeway camp surrounded by the banks and ditches of an Iron Age entrenchment and a series of flint mines which, with the possible exception of Grimes Graves in Norfolk, are the oldest in the country. Fishing, which was the only industry of the old village, is no longer carried on, and the principal industry of to-day is in connection with the tourist traffic.

WOTAN. See ODIN.

WOUNDS. Lacerations of the flesh, which are the visible results of injuries. Cuts, skin abrasions, burns, and internal lacerations are among the different kinds of wounds. Wounds that heal quickly without the formation of pus are said to heal by *first intention*. Accidental cuts, bruises, abrasions, etc., caused by sharp or blunt instruments, glass, wheels of vehicles, and other objects, often become infected, because the surfaces of these objects usually have germs on them. When infection does occur, the healing is said to be by *secondary intention*, and it is aided by the formation, in the wound, of small pebbly masses of flesh called



WORTHING FROM THE PIER

Photo Taylor

granulations. These small bodies serve as a natural protection against the progress of the bacteria. See **FIRST AID**.

WRANGELL, OR WRANGEL, ISLAND. A large island in the Arctic Ocean, 85 miles from the Siberian mainland. It has an area of about 2000 sq. miles, being 80 miles long and from 18 to 30 miles wide. Though a desolate, valueless land of naked granite

except Australia and Africa. They are commonest in the New World. The European wrens have a short bill and short tail, which is generally carried cocked, but in the American species are found forms in which the bill and tail are much longer. The bill is slender and slightly *curved*, and the food is mainly insects and their larvae, and some seeds.

There is only one species of wren in Britain. It is found almost everywhere in wooded and open country, and even in rocky places. Its small size, cocked tail, brown colour and skulking habits make its identification easy. The wren is a permanent resident in Britain, remaining during even the severest winter. Some other species of birds are called wrens, though they do not belong to the family of true wrens. There are, for example, the golden-crested and the fire-crested wrens.

Scientific Name. The common British wren is *Troglodytes troglodytes*.

WREN, SIR CHRISTOPHER (1632-1723). An English architect, born at East Knoyle, Wiltshire, educated at Oxford. His work as an architect early became known, and he was one of those commissioned to rebuild the old St. Paul's Cathedral. He had scarcely more than submitted plans for it when it was completely ruined in the great London fire of 1666. This gave Wren the opportunity to reconstruct it entirely. The cathedral was completed in 1710, and is a magnificent structure, 510 ft. in length with a great dome and twin western towers. The



COMMON WREN AT NEST

Photo: John Kearton

rocks, rarely visited because of the impassable ice pack which surrounds it, it may be some day valuable as an aeroplane base.

The U.S.S.R. claims ownership. The Soviet Government maintains a meteorological station on the island.

WREN, *ren*. The common name of the members of a family of small birds which are found over the greater part of the world,

vast Renaissance building remains Wren's masterpiece, though it was not completed according to his favourite design.

Following the Great Fire, Wren designed fifty churches to replace those which had been destroyed, and, in addition, he made plans for the rebuilding of London, though they were not carried out.

Wren was knighted in 1673 by Charles II, served in Parliament for several years, was elected president of the Royal Society in 1681.

Among his London churches are St Stephen's, St Michael's, St. Mary-le-Bow, and St Bride's. He also designed the old Royal Exchange, Marlborough House, Buckingham House, the Sheldonian Theatre and Queen's College chapel at Oxford, and the library of Trinity College, Cambridge.

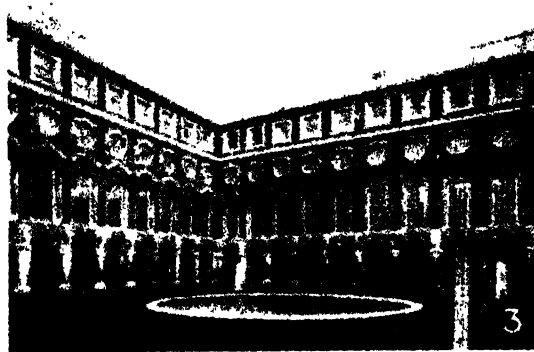
WRESTLING. A favourite sport which has been practised continuously since the days of classical Greece and perhaps much earlier.

Graeco-Roman. The name of this style of wrestling is misleading, it was really developed in France, and has less in common with the sport practised so skilfully by Greek and Roman athletes than has catch-as-catch-can. Graeco-Roman wrestling is a very restricted style and usually a time-limit is imposed. The opponents are not permitted to seize each other anywhere below the belt, nor are they allowed to trip each other. Most of the struggle takes place on the mat, and a fall is scored when one of the contestants forces the two shoulders of his opponent to the ground. Bulk and endurance count greatly in this style.

Catch-as-Catch-Can Style. Also known as the Lancashire style, this is the favourite form of wrestling in Great Britain. Its popularity may be explained, perhaps, by the fact that it is a very free style, allowing a great deal of liberty to the opponents, encouraging and rewarding strategy, and permitting every legitimate kind of artifice. Tripping is permitted, but, of course, kicking and throttling holds are barred. As the name sufficiently indicates, the holds in this style are taken at random, and the wrestlers struggle to throw each other to the mat or floor. When one of them succeeds in pinning his opponent's two shoulders to the floor, he wins a fall.

Collar and Elbow. This style, now obsolete in England, was popular until 1880.

It is recognized as the national style of Ireland. The wrestlers wear a short coat or jacket, with stout collar and sleeves, to afford a good grip. Each man seizes the collar of his opponent with his right hand and with the other hand takes a firm hold on the sleeve near the elbow. The hand on the collar must be opposite the opponent's left ear. During the struggle neither grip must be relaxed on pain of losing. Kicking



BUILDINGS BY SIR CHRISTOPHER WREN

1. The Sheldonian, Oxford. 2. Greenwich Hospital.
3. Hampton Court Palace

Photos: Taylor

is a foul, but leg locks and trips are legitimate. A man is thrown when two shoulders and one hip, or two hips and one shoulder, touch the mat, providing the three points make contact with the ground simultaneously.

Cumberland and Westmorland. In this style the adversaries stand chest to chest, grasping each other round the body with locked hands and with chin resting on the other's right shoulder. With the exception of kicking, any manoeuvre to throw an opponent is permitted. A fall is gained when one of the contestants is forced to touch the



WRESTLING
1. Cornish style. 2. Catch-as-catch-can.
3. Cumberland style.

Photos: Central; Fox; Topical.

ground with any part of the body (except the feet) or if his hold is broken. If both men fall together and touch the ground simultaneously, the bout must commence again.

WREXHAM. See DENBIGHSHIRE.

WRIGHT, ORVILLE (born 1871), and **WILBUR** (1867-1912). The inventors of the first machine to fly. Both brothers were born and educated in the United States.

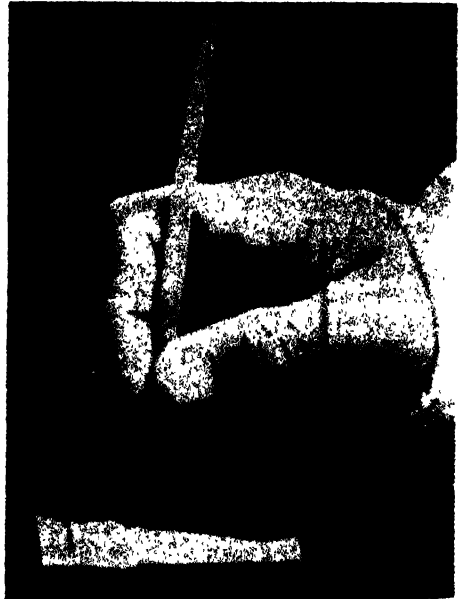
After 1903 the Wrights devoted themselves chiefly to the perfection of their flying machine, which, including motors, they had manufactured with their own hands. In 1908 Wilbur made his first public flight in France, winning the decoration of the Legion of Honour; Orville won similar recognition by flights in America. The following year their machine was accepted by the United States government for use in the army.

After Wilbur's death, in 1912, Orville continued to improve the Wright aeroplanes as a manufacturer.

WRIT. A document containing a com-

mand from the King to one of his subjects. Most writs are issued by courts of law for the purposes of legal proceedings. The most important kinds of writs are (a) *writs of summons*, by which a defendant to an action in the High Court is summoned to appear, and *writs of subpoena*, by which a witness is ordered to attend to give evidence (see SUBPOENA); (b) *writs of execution*, which are directed to the sheriff of a county, commanding him to seize the property of a judgment debtor for the purpose of satisfying the judgment (see JUDGMENT); (c) *writs of habeas corpus* (see HABEAS CORPUS); and (d) *election writs* (see ELECTION).

WRITING. Writing appears comparatively late in the history of the human race. Picture writing is the earliest form discovered. Gradually, the pictures came to be used for symbols; then two or more were combined, and in this way the meaning of a symbol was extended. This sort of picture writing reached its highest state of perfection among the Egyptians, who engraved their monuments with designs to which the term *hieroglyphics* was given.



USING A STYLUS
Making a so-called "head" of cuneiform script.
Photo: Field Museum of Natural History

From the combination of pictures into symbols, writing passed to the stage in which it is now used, that in which the symbols represent sounds, and combinations of these symbols form words. All the symbols used to represent the sounds of a language constitute the alphabet of that language. Writing in which symbols represent sounds is called *phonetic*. The Phoenicians are given credit for inventing the first phonetic alphabet. Between the phonetic alphabet of the Phoenicians and the hieroglyphics of the Egyptians, we find the wedge-like writing of the Babylonians and other nations of the East. See ALPHABET, LANGUAGE; LANGUAGES OF THE WORLD.

WRYNECK, *ri nek*. A very small group of birds found in the temperate regions of the



WRYNECK AT NESTING HOLE
Photo E. J. Hasking

Old World and in Africa. The name originates from its extraordinary ability to twist its neck.

The wryneck is a summer visitor, though not a particularly common one, to southern Britain. It arrives a few days before the cuckoo, and in consequence has been given the names "cuckoo's mate" and "cuckoo's

leader." Another name it is entitled to is "snake-bird," owing to the hissing noise it makes when disturbed on its nest. The nest is just an old cavity in a tree or in a bank. The texture and beautifully variegated colours of its plumage are very like those of the nightjar.

Scientific Name. The wryneck is *Jynx torquilla*.

WÜRTTEMBERG, *vir' tem ber'K*. After November, 1918, a component republic in the republic of Germany. Prior to that time, Württemberg was one of the kingdoms of the German Empire. It is situated in the southwestern part of Germany, between Bavaria and Baden, and has an area of 7,530 sq. miles and a population of 2,696,324. The surface of the country is generally mountainous, and most of the soil is fertile, producing wheat, barley, beets, potatoes, tobacco, flax, and hemp; fruit trees flourish everywhere, and excellent wines are produced from its thrive-

ing vineyards. The Black Forest, in the south-west, provides vast quantities of timber. Iron and salt are its most important minerals.

Stuttgart, the capital, is the publishing centre in the southern part of the German republic. Textiles, dyes, gold, silver, and metal wares, and surgical and optical instruments are manufactured, and there are large breweries, brickyards, and sugar refineries in the industrial centres. Population, 415,011 (1933).

WYCHERLEY, WILLIAM (1640-1716; Wycherley is best-known as the author of four comedies, *Love in a Wood* (1672), *The Gentleman Dancing-Master* (1673), *The Country Wife* (1675), and *The Plain Dealer* (1677).

His friendship and quarrel with Pope are famous. In 1735, Pope published his correspondence with Wycherley, which Professor Courthope has shown to be elaborately altered in order to convey the impression of the superiority of the sixteen-year-old Pope to the aged and experienced Wycherley.

WYCLIF, JOHN (d. 1384). English philosopher and divine. He had a large following at Oxford as a philosopher and theologian long before he was denounced by the Church as an heresiarch. His philosophy was a moderate realism.

opposed to the nominalism of Paris. His conception of the Christian religion was essentially ethical and practical, and found expression in the institution of his "Poor Preachers" and in the translation of the Bible which he caused to be made.

It was Wyclif's spiritual interpretation of the eucharist, which he made for the first time in 1381, that gave the Church its opportunity to attack him and his followers for heresy. The Chancellor of the University of Oxford was summoned before a tribunal at Lambeth and ordered to suppress Wyclifism. But Wyclif himself escaped any kind of personal attack, so great was his reputation in Oxford.

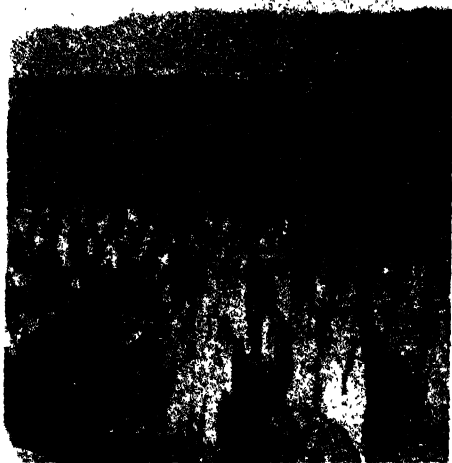
Wyclifism or Lollardism (the literal meaning of "Lollard" is one who lolls, that is, sings or mumbles prayers and hymns), survived long enough to be merged in the Lutheran heresies of the sixteenth century. See LOLLARDS.

WYCOMBE (officially Chepping Wycombe,



JOHN WYCLIF
Photo Brown Bros.

and also Chipping or High Wycombe). A town and municipal borough of Buckinghamshire, situated 26½ miles from London on the G.W.R. Formerly an important Roman station it is now a centre for the



"THE NEEDLES," WYOMING
They were cut by the Yellowstone River
Photo. U. & U.

manufacture of cane- and rush-seated furniture. The present charter dates from 1663. Population (1931) 27,987.

WYOMING. A Western State of the American Union. It lies in the broadest

part of the Rockies, and has an area of 97,914 sq. miles, of which 366 sq. miles are water. The population (1930) is 225,565, thus making Wyoming the most sparsely populated State in America. Cheyenne, with a population in 1930 of 17,361, is the largest city.

The Medicine Bow, Laramie, Seminole, Sierra Madre, Granite, Green, Ferris, and Rattlesnake ranges form the south-eastern section from South Dakota, the Big Horn Mountains extend into the central part of the State from the north. Glaciers have left many lovely lakes and waterfalls. The scenic beauty of Wyoming is world famous. The State occupies a plateau 5000-7000 ft. above sea-level and includes Yellowstone National Park. The loftiest mountain is Gannett Peak, whose snow-crowned summit rises to a height of 13,785 ft. Fremont Peak, in this same range, is 13,720 ft. in altitude.

Until recently Wyoming was principally a grazing country, but to day an increasing area is devoted to the raising of crops including wheat, oats, maize, and rye.

The oil industry has shown remarkable growth, and Wyoming is now among the six leading oil-producing States in the Union. The refining of petroleum also constitutes the chief manufacturing industry.

WYSS, DEES, JOHANN RUDOLF (1781-1830). A Swiss author and educationist, born at Berne where he held the position of professor of Philosophy. His works include the Swiss National Anthem and the *Swiss Family Robinson* which has been translated into most European languages.

THE WORLD BOOK

Xx

X. The twenty-fourth letter of the English alphabet. The Phoenician alphabet had a consonant with a somewhat sibilant, s-like sound, which bore the form shown in the illustration. This form was a rough sketch of a post or pillar, and the



Phoenician name for the letter was *samech*, which meant "support." The Greeks took over the letter, in modified form, and the Romans adopted it in its *ks* sound, which is its common sound in English. As an initial letter, it has the sound of *z*, as in *Xerxes*.

XENOPHON, zen' o fon (about 434 B.C. to about 355 B.C.). An Athenian historian and soldier. In 401 B.C. he joined the expedition of Cyrus the Younger against Artaxerxes of Persia (see **CYRUS, THE YOUNGER**). At the Battle of Cunaxa, Cyrus was killed, and shortly thereafter, the satrap Tissaphernes put the Greek generals to death. Ten thousand Greek mercenaries were thus left in a strange country, with no one to command them, but they chose Xenophon as their leader, and set out on their march toward home. After innumerable hardships, they reached the Bosphorus.

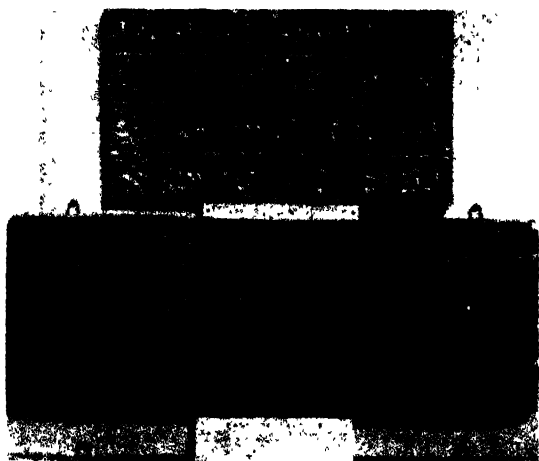
Returning to Greece, Xenophon fought with the Spartans against Athens and was therefore banished from his native city.

Xenophon's *Anabasis*, an account of the expedition of Cyrus and the retreat of the 10,000 Greeks, is the most famous of his writings. He also wrote the *Hellenica*, a history of the last part of the Peloponnesian War, intended as a sequel to the history of Thucydides; the *Memorabilia*, or recollections of Socrates; and the *Symposium*, a discussion of an imaginary banquet at which Socrates was supposed to have taken part. The clarity of Xenophon's style and the care which he took to ensure the accuracy of the facts narrated has made him an important source for the history of Greece during this period.

XERXES, zerk' zez. The name of three kings of Persia, the most famous of whom was Xerxes I.

Xerxes I (about 519 to about 465 B.C.) was the son of Darius I. He came to the throne in 485 and planned immediately to conquer Greece and so avenge the defeat of Marathon. Tradition has magnified the size of his army and the greatness of his deeds. He is said to have had a million men. He threw two bridges, formed by a double line of boats, across the Hellespont, and cut a canal through the isthmus of Mount Athos Peninsula. His army required 1207 ships-of-war, attended by 3000 smaller vessels to cross the Hellespont.

At first, Xerxes was victorious—at Artemisium, Athens, and



XERXES I OF PERSIA

Casts of Babylonian inscriptions in the British Museum. The upper inscription records the name and titles of the King; the lower records the completion of a palace begun by his father Darius.

Photo: Mansell

Thermopylae. But the tremendous fleet was crushed at the Battle of Salamis, in 480 B.C., and with no further communication by sea with Asia, Xerxes fled to Sardis. The army was routed at Plataea the following year. In later years Xerxes's power diminished, and he was murdered by Artabanus, a captain of the guards. His son, Artaxerxes I, succeeded him.

Xerxes II was the son of Artaxerxes I, and lived approximately between the years 450 and 425 B.C. When his parents were murdered, he ascended the throne, but was assassinated after a rule of 45 days.

Xerxes III, sometimes called Oarzes, ruled in Persia about 337 B.C.

X-RAYS. See ROENTGEN RAYS; SURGERY.

XYLENE. The name given to three forms of hydrocarbons which occur in the light oil fractions of a coal tar distillate. Their boiling points are too close to permit of their separation by distillation, but the mixture can be separated with sulphuric

XYLOPHONE, *si' lo fohn*. A musical instrument composed of sticks of wood selected for their sounding quality, and graduated



XYLOPHONE

so as to sound the chromatic scale. They are played by striking with wooden mallets, one being held in each hand. The xylophone is used in modern orchestras for special effects and as a solo instrument.

THE BOOK

Yy

Y. The twenty-fifth letter of the English alphabet, used both as a consonant and as a vowel. The Greeks added to the Phoenician alphabet, when they adopted it, a character which was sometimes made like a capital V, sometimes like a Y, and which represented the *oo* sound. Gradually, the Y form of the letter became established, and the sound changed to that of the German *u*, which is not found in the English language. The Romans adopted the letter for use in Greek words, and from them it came into the English alphabet, where, by degrees, it acquired its present value.

As a vowel, y has all the sounds of i except that in *machine*. As a consonant, there is no other letter which could exactly take its place, though even in such words as *yellow*, the initial sound closely resembles that of the short i in *it*, slighted in pronunciation.

YACHTS AND YACHTING. Yacht racing did not become universally regarded as a sport until early in the nineteenth century, but its actual origin is difficult to trace. Authentic records show that the first private sailing vessel was built in 1660 and presented to Charles II and there is reference to a race between sailing boats in 1601. Vessels of widely varying designs were seen on the water in the early days of yacht racing.

At first mostly they took the shape of small galleys and brigs with gigantic, cumbersome sails. Ireland claims the honour of founding the first yacht club, for it was in 1720 that the Cork Harbour Water Club, afterwards known as the Royal Cork Yacht Club, came into being. In 1811 a yacht and boat club, known as the Knickerbocker Boat Club, was formed in New York. It was not until 1844 that the first of such organizations to survive—the New York Yacht Club—was founded.

The Royal Yacht Squadron, Britain's premier club, was formed in 1815. Subsequent to that date many yacht clubs were organized in all parts of Great Britain where there are now upwards of 350 organized clubs.

Since the close of the World War, yachting has experienced a boom. An increase in the number of yachts has been brought about by the fact that racing yachts, as a whole, are of smaller size than before the war.

In the big regattas held round the coast during the summer, such as that at Cowes,

yachts are handled by amateurs with amateur crews, excepting that, in the larger yachts, a few paid hands do the heavier work.

Before 1919, most of the sailing yachts, of whatever rig, had gaff sails; that is, rectangular sails with wooden gaffs at the heads and booms at the foot. But it was found that a triangular sail, tall and narrow, with no gaff and a shorter boom on the foot than formerly, was more efficient, and gradually the triangular sail replaced the gaff-headed sail. These rigs, when first introduced, were called *Marconi* rigs, but the rig is now more commonly called the *Bermuda* rig (from the early Bermuda yachts that used a triangular or modified leg-o'-mutton sail).

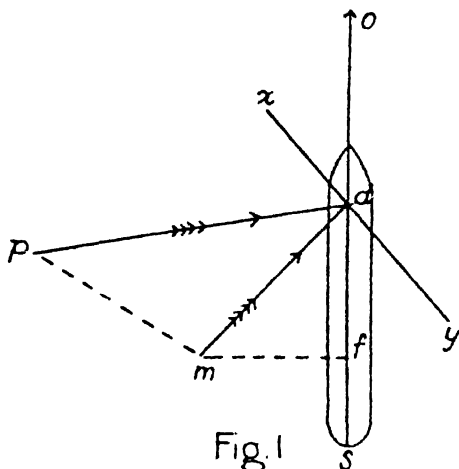
Types of Rigs. Yachts are classified by their rigs, and racing yachts are still further divided for classification by their size, or rating. The chief rigs in common use to-day are the following—

Sloop. A single-masted vessel carrying a main sail abaft the mast and a single jib, or head-sail, forward, which may or may not set from a bowsprit, depending on the type of hull. Most modern racing sloops have a long forward overhang to the hull, and no bowsprit.

Cutter. A single-masted vessel, similar to a sloop, but with two or more jibs, or head-sails, instead of a single jib. The mast is usually stepped somewhat farther aft than in a typical sloop. In America the term

cutter refers to the rig alone, though in Great Britain, where the term originated, a more or less distinctive type of hull was developed for the rig.

Yawl. A two-masted boat, the mainmast being the larger and stepped about where it is in a sloop, and the mizzen, or jigger,



SAILING WITH WIND ABEAM

xy represents the sail and *pd* the wind. The wind blowing against the slanting sail is deflected and causes a pressure *md* perpendicular to the surface. The pressure *md* can be resolved into two components *mf* and *fd*. The former tends to push the boat sideways, but is largely counteracted by the push of the water against the boat's side. *fd* is in the direction of the ship's course and propels it towards *o*.

being much smaller and stepped well aft, behind the rudder head or stern post. The usual head-sails, either one or two, are carried.

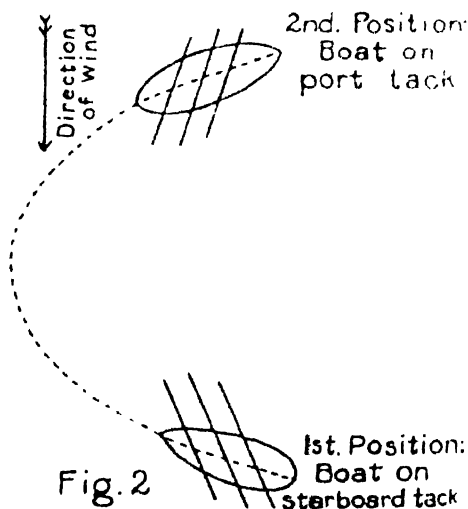
Ketch. The ketch rig is very similar to the yawl, and from a distance is sometimes hard to distinguish from the latter. It has the mainmast and head-sails placed as in a yawl, but the aftermast and sail are larger than in the yawl, the mast being stepped forward of the rudder head or stern post, or forward of the afterpoint of immersion of hull. It is this position of the mizzen mast that differentiates the yawl from the ketch.

Schooner. The schooner is a two-masted vessel, the mainmast, the larger of the two, being placed somewhat aft of amidships, and the foremast being forward. The usual jibs, or head-sails, are forward of the foremast. Very large yachts may have a three-masted schooner rig, the names of the masts being fore, main, and mizzen.

Slaysail Schooner. Soon after the year 1920, a Boston schooner yacht, named the *Advances*, made its appearance, having the

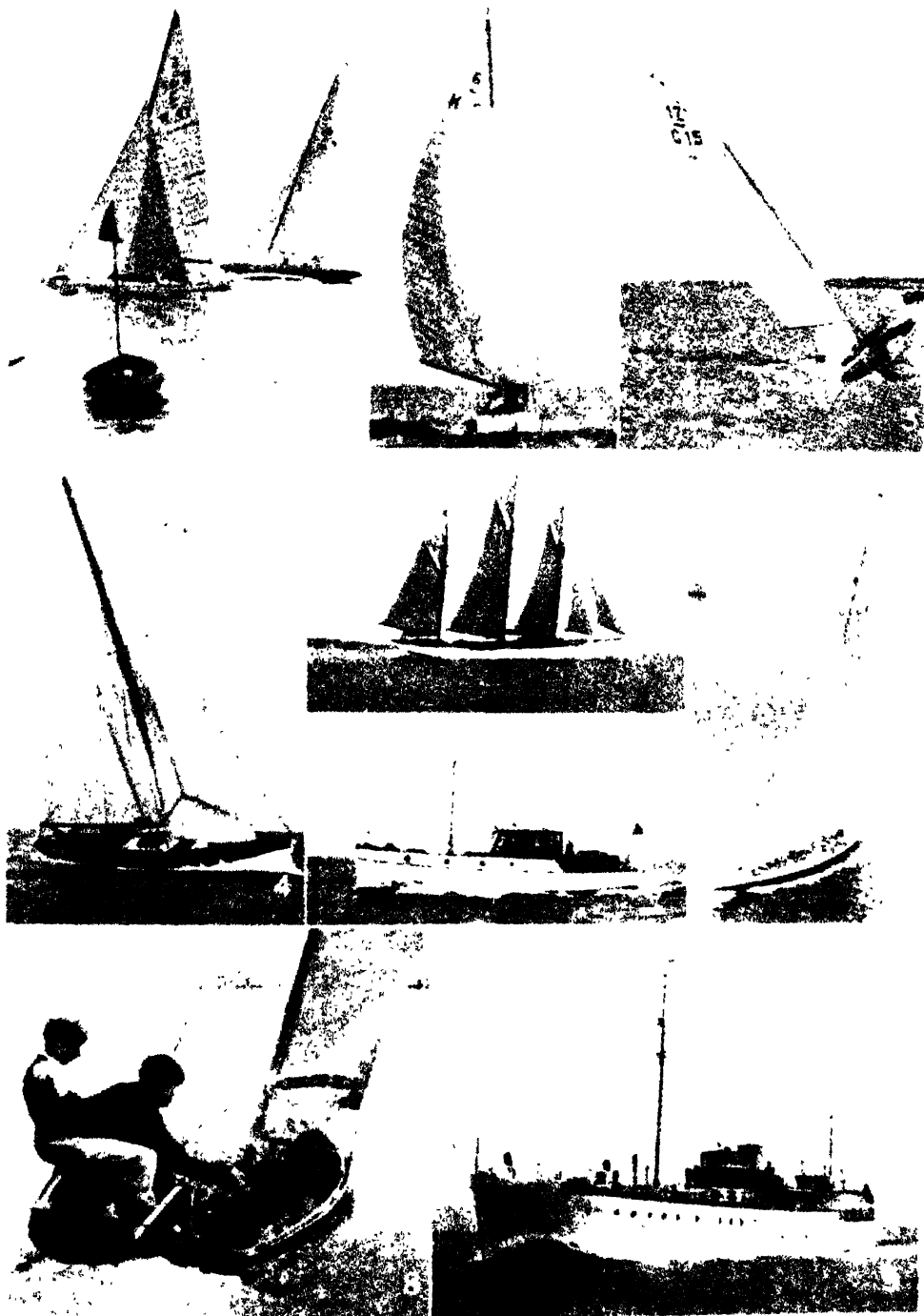
space between the two masts filled by triangular and quadrilateral staysails, instead of the gaff foresail. The rig proved very close-winded, and has become popular in racing schooners, many of which are now rigged in this way.

The America's Cup. An American 170-ton schooner, built by Mr. G. Steers and named *America*, set sail from New York in 1851 to compete in the regattas arranged in England in connection with a world fair. During her stay the *America* took part in a race round the Isle of Wight for a Cup presented by the Royal Yacht Squadron and in the face of stiff opposition from fifteen British vessels the American schooner triumphed. The trophy which she won has now become the most coveted prize in the yachting world. Presented to the New York Yacht Club, the trophy was offered as a perpetual challenge cup open to any organized foreign yacht club. Britain, since 1870, has made many unsuccessful attempts to capture the trophy, while in 1876 and 1881 Canadian boats took up the challenge. Between 1899 and 1930 the late Sir Thomas Lipton challenged five times with his series of *Shamrocks*, but on each occasion the American defender won. In 1934 Mr. T. O. M. Sopwith built his Bermuda-rigged cutter, *Endeavour*. His



SHOWING THE CHANGED POSITION OF THE SAILS OF A VESSEL CHANGING FROM STARBOARD TO PORT TACK

challenge was met by the Americans with a vessel of the same class named *Rainbow*. In a series for the best out of seven the British boat scored fine victories in the first two races, but *Rainbow* then won four races in succession to retain the Cup. In 1937 Mr. Sopwith challenged again.



TYPES OF YACHT

1. Start of a race for six metre yachts. 2. *Lalage*, chosen to race at the Olympic Games. 3. Racing a 12 square Sharpie class boat. 4. Auxiliary Bermudan Cutter *Mistress*. 5. A steel auxiliary schooner ketch rigged yacht. 6. A 40-footer twin screw motor cruiser. 7. *Endeavour II*, the J class challenger for the America's Cup. 8. Racing a 12-ft. dinghy. 9. The *Braemar*, 174 ton, twin screw motor yacht.

: Samuel White & Co.; Topical; Central

YAJA, OR JAJFA, yak' fa. A seaport of present-day Palestine (which see).

YAHWEH. See **JEHOVAH.**

YAJUR-VEDA. See **VEDAS.**

YAK. The wild ox of Tibet. It stands nearly 6 ft. high at the shoulder. It has long, silky black hair, which covers the body and



YAKS

Photo: U. & U'

hangs in a thick fringe along the sides. Apparently, its coat of hair was developed as a protection against the cold. The yak possesses spreading horns and carries its head low.

The domestic yak, called the "grunting ox," is smaller, and is often mottled black and white in colour. Its principal use is as a beast of burden; but milk is derived from the cow, and ropes, tent coverings, etc., are manufactured from its long hair.

Scientific Name. The yak belongs to the family *Bovidae*. Its scientific name is *Bos grunniens*.

YAKUTSK REPUBLIC. An autonomous State within the U.S.S.R. covering the basin of the Lena and Kolyma rivers in Eastern Siberia. The area is about a million square miles and the population is estimated at 308,000 (1931). Hunting, fishing, gold mining, and salt working are the chief occupations. Yakutsk, a small town on the Lena, is the capital.

YAM. Plant whose edible roots somewhat resemble the sweet potato. It grows in the warmer regions all over the world, but is especially common in China and the South Sea Islands, in Australia, and in the southern parts of North America. The plant has long, slender, climbing stems, and bears small, green flowers in clusters. In some species the roots are more than 3 ft. long and weigh over 30 lb.

In China, where land holdings are small and economy of space correspondingly important, a trench from 10 to 15 ft. long can be made to produce enough yams to supply one man for a year. The Chinese grow another variety called a dye yam,

from which they obtain tan and dark-brown colours for dyeing.

Scientific Name. Yams belong to the family *Dioscoreaceae*, and are species of the genus *Dioscorea*.

YANGTZE KIANG, yahng' tse kyahng', OR YANGTZE. The longest and the most important of the rivers of China. It has its source in the Tang-la Mountains of Tibet, and follows an irregular eastern course through the central part of China, entering the Yellow Sea over 3000 miles from its source.

Large ocean steamers ascend the stream to Hankow, 680 miles from the mouth, and smaller boats can go about 500 miles farther, to Ichang. About half the sea commerce of China is distributed by means of the Yangtze. Among the great cities built on its shores are Nanking, the Nationalist capital, Chinkiang, and Soochow. The Yangtze is subject to disastrous floods.

YARD. A standard measure of length in the English system, equivalent to 36 in. or $\frac{1}{4}$ part of a mile.

YARKAND. See **SINKIANG**

YARN. See **COTTON**; **WOOL**.

YARROW. The name commonly applied to the milfoil, a plant found not only in Great Britain but also in North America. As the name milfoil implies, it has leaves very much divided so that the appearance of a multitude of tiny leaves is given. The flowers, borne in racemes or flat clusters at the ends of the stems, are usually white or red.



YARROW

Photo: E. J. Hosking

Scientific Name. The yarrow is *Achillea millefolium*.

YAWL. See **YACHT AND YACHTING**

YAWNING. The act of gaping or opening the mouth wide, especially when the act is involuntary. It is often due to fatigue, but if frequent or habitual, may indicate that the person affected is not getting enough air to his tissues. Want of ventilation may be the cause, or want of exercise. When yawning occurs after a heavy meal, the need of exercise is apparent; but bathing the face with cold water, or drinking a refreshing beverage, will generally cause the disposition to yawn to disappear.

The physiological cause of yawning is disputed. In the upper portion of the spinal cord, there is a small nerve centre which controls the group of movements that we call yawning, but it is not known what brings this centre into action. It is a curious fact that the disposition to yawn seems to be infectious.

YEAR. The period of time occupied by the earth in making one complete revolution around the sun. The solar, equinoctial, or tropical year, which may be defined as the interval of time between two successive passages of the sun through the vernal equinox, is 365 days 5 hours 48 minutes 45.51 seconds. The use of a calendar year of 365 days makes necessary the introduction of an extra day every fourth year, to correct the difference between the calendar year and the true year. This fourth year is called *leap year*, and the extra day is 29th February. As the addition of a day, however, over-corrects the difference by 44 minutes 56 seconds, leap year is omitted in century years, except those divisible by 400.

The sidereal year consists of 365 days 6 hours 9 minutes 9 seconds. This is the time required for the earth to make a complete circle of its orbit. It differs in length from the solar, or tropical, year, because of the precession of the equinoxes. The lunar year consists of twelve lunar months; this was the ancient Greek year of 354 days.

The Church calendar adopted in the Roman Catholic and most Protestant Churches is regulated partly by the solar and partly by the lunar year, thus causing the distinction between fixed and movable feasts. The fixed feast days are determined by the solar year, the movable feasts by the lunar. See **TIME**.

YEAST, yeast. A mass of tiny, one-celled plants, which are among the simplest forms in the vegetable kingdom. The yeast plant is classed as a fungus (see **FUNGI**). New cells are produced by a process called budding. That is, a small formation pushes out from the cell wall, and soon the new growth is shut off by a wall of cellulose. It then becomes an independent cell, from which others may grow.

The chemical change that yeast produces in organic substances is known as fermentation, and it represents the feeding of the yeast cells. While growing and multiplying, each cell secretes small quantities of two organic substances, called *zymase* and *invertase*. Fermentation results from the activity of these enzymes, or ferments, which act by decomposing the food material for the yeast cells, i.e. starch and sugar in solution. Zymase acts upon starch; invertase acts upon sugar in such a way that it can be decomposed by the zymase. These

ferments can do their work only when there is moisture and a favourable temperature; the range of the latter is about 80° to 85° Fahrenheit. Yeast is widely used in bread and cake making. Before it was manufactured on a commercial basis it was made by preparing a batter of flour, potato water, salt, and sugar. Yeast cells from the air furnished the necessary ferments.

In the commercial production of yeast, maize and rye are reduced to a mash by grinding and mixing with filtered water. Barley, or malt, is then added, and this changes the starch in the grains to malt sugar. Next, a culture of the kind of bacteria that turn milk sour is placed in the mixture, and the mash is filtered. The resulting liquor, called *wort*, is now ready to serve as food for the living yeast cells which are placed in it. The yeast is skimmed off and freed from water by pressure. Finally, the mass is moulded into a form suitable for cutting into cakes of the desired size.

YEATS, WILLIAM BUTLER (born 1865). Irish poet and dramatist, born in Dublin. He was educated at Godolphin School, Hammersmith, and Erasmus School, Dublin. He was an art student for three years, but gave up art for literature when 21. Member of the Free State Senate, 1925-1928, a Nobel prize winner for literature (1923) and Doctor of Literature *Honoris Causa*, Dr. Yeats enjoys a world wide reputation. He was one of the founders of the recent Irish



W. B. YEATS
Photo: U. & U.

Literary movement. In conjunction with Edward Martyn, Miss Annie Elizabeth Horniman, of Manchester, Lady Gregory and others, he founded the Abbey Theatre, Dublin. His publications include: *The Wanderings of Oisín* (1899), *The Countess Cathleen*, *The Celtic Twilight*, *The Poems of William Blake* (with E. J. Ellis), *The Shadowy Waters*, *Cathleen ni Houlihan*, *The Cutting of an Agate*, *The Wild Swans at Coole*, *Seven Poems and a Fragment*.

YELLOW. One of the colours of the solar spectrum. With blue, it forms green; with red, orange; blue, yellow, and red lights mingled give white light. It is the national colour of China. Strong light increases the intensity of yellow; most colours are dimmed by it.

See **COLOUR**.

YELLOW FEVER. An infectious disease in which jaundice, marked by a yellowish tint of the skin, is a characteristic symptom. Yellow fever is transmitted from person to person by the bite of a mosquito (*Aedes aegypti*) which has itself fed on the blood of a yellow fever patient. Except for a few local areas in South America, and a district along the West Coast of Africa, yellow fever has been practically overcome by modern preventive medicine.

YELLOW-HAMMER. A corruption of the German *ammer*, "bunting," it is a name



MALE YELLOW-HAMMER AT NEST
Photo. Cherry Kearton

that properly belongs to the yellow bunting, one of the most common of the small birds of Great Britain and other parts of Europe.

The yellow bunting has brilliant plumage of yellow, varied by dark patches of brown, and dusky-black wings edged with gold. Its songs are short but very sweet. According to an old tradition, it flew too near the Cross, and its plumage became stained with blood. As a punishment, it was said, the eggs were spotted with red.

Scientific Name. The yellow bunting belongs to the family *Fringillidae*. Its scientific name is *Emberiza caesia*.

YEMEN, yem'en. A territory in the south-western part of Arabia, noted for its excellent coffee. It adjoins the British protectorate of Aden on the south, and extends northward on the eastern border of the Red Sea from the Strait of Babel-Mandeb to Asir. The title of the ruler is the Imam of Yemen. It has an area of 75,000 sq. miles, and is mountainous with lofty plateaux from 8000 to 10,000 ft. high, which extend into the interior. A series of arid terraces rise from the coast to the mountains, but extensive areas are devoted to the culti-

vation of coffee, and stock raising is also important. A limited amount of cereals is raised. Hodeida is the leading port, though Mocha (Mokha) is also on the coast. The estimated population is between 2,000,000 and 3,000,000. Sana is the capital; it is a walled city with eight gates, and has a population of over 20,000. See ARABIA.

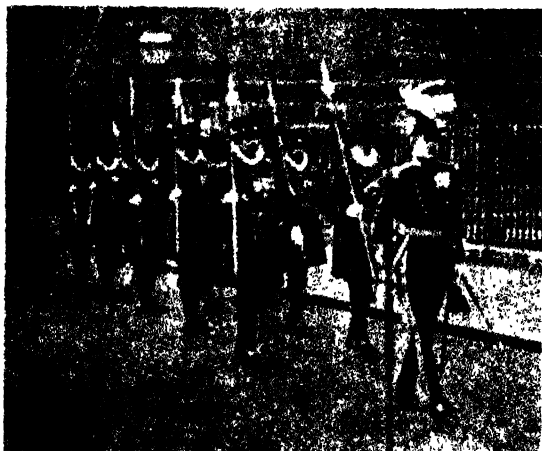
YEN. The monetary unit of Japan with a par value of 2s. 0½d. It is based on the gold standard, adopted in 1897. The yen is divided into 100 *sen*, and the *sen* again into 10 *rin*.

YEOMAN, yo' man. A term of uncertain origin, signifying a retainer or dependent of a feudal lord, often a forester; a small land owner or farmer of the middle class, between the gentry and labourers. The yeomen of England in the fifteenth century have been described as the small freeholders of the feudal manors. This class, especially its younger sons, furnished the ranks of England's armies. The word thus developed a semi-military significance and was used to describe the cavalry of the militia or citizen army. See YEOMANRY.

Almost all of the yeoman class were reduced to the status of wage-earners by the Industrial Revolution.

Yeomen of the Guard. A body of veteran soldiers, selected to act as bodyguard to the person of the sovereign. The Corps of Yeomen of the Guard was instituted by commission during the reign of Henry VII in 1485.

Its members wear the costume of fifteenth-century soldiers serving in the presence of the sovereign, with scarlet, black, and gold tunic, wide knee breeches and buckled



"BEEFEATERS" AT THE STATE OPENING OF PARLIAMENT
Photo. Fox

shoes, topped by a ruff and bonnet; their weapon is a halberd.

Their officers are eight in number and some bear ancient titles of rank, such as Clerk of Cheque and Adjutant, Ensign and Exon.

The full title of the corps is now, The King's Bodyguard of the Yeomen of the Guard. Their headquarters are in the Tower of London.

The popular name of "Beefeaters" is often applied to the Yeomen of the Guard, as well as to the warders of the Tower of London, who wear a similar dress, and is derived from the soldier's free issue of a beef ration and not from "Buffetier"—an attendant at the buffet—since these yeomen were never employed as servers of viands.

YEOMANRY, yo' man ri. Bodies of volunteer cavalry, raised and drilled on a county basis and providing their own horses and uniform.

They rendered powerful aid to the English armies in early days—hence, "to render yeoman's service."

During the period of the French Revolution, Lord Lieutenants began to raise and organize bodies of volunteer cavalry in their



ENGLISH YEW
Photo: E. J. Hosking

respective counties and arrange for their equipment and drill. Unlike the Territorial Army, the Yeomanry could be called out in aid of the civil power.

Originally there were fifty-three yeomanry regiments in Great Britain, the two senior regiments being the Royal Wiltshire and the Warwickshire Yeomanry.

The Yeomanry rendered distinguished service in the South African War and in the World War, both as mounted units and as infantry in the later stages of the World War.

When the Territorial Army was reconstructed in 1920 the first fourteen regiments were retained as cavalry; the remainder were either converted into field and medium artillery, armoured car companies of the Royal Tank Corps and scouts, merged into

Territorial Army units of infantry—as in the case of the Montgomeryshire Yeomanry—or disbanded.

YEOVIL. See SOMERSET.

YEW. The name given to a genus of evergreen trees and shrubs with spiny foliage, scarlet berries, and purplish, scaly bark. The European yew, a native of Europe, Asia, and Africa, is especially abundant in the region of the English Channel, where the chalky soil seems best adapted to its growth. This tree has mournful associations, having been planted, in former



IRISH YEW
Photo: E. J. Hosking

times, in English churchyards. Long ago, warriors' bows were made of its tough, elastic wood. There is a record of one yew which attained a circumference of 57 ft., and an age of almost 3000 years.

American species include the tall-growing western, or Pacific, yew, whose wood is valued for cabinet work and the Florida yew, of shrublike habits of growth.

Scientific Names. The yews belong to the family *Taxaceae*. The European yew is *Taxus baccata*, the western, *T. brevifolia*, the Florida, *T. floridana*.

YGGDRASIL, ig' dra sil The great world ash of Norse mythology, called "tree of the universe," because its wide-spreading roots bound together heaven, earth, and the underworld. It symbolized existence, and was the tree of life, knowledge, fate, time, and space. Literally, its meaning is "bearer of Odin, or Yggdr." Its stem was supposed to uphold the earth, while its branches overshadowed the world and reached up beyond the heavens. Beneath its branches, evergreen and dripping honeydew, the gods held daily council.

YOKOHAMA, yo ko hah' ma. The sixth largest city of Japan, a seaport and commercial centre, situated on the southern shore of the island of Honshu, 18 miles south of Tokyo. It has a population of 703,900.

As a treaty port, the city exports chiefly raw silk and silken fabrics, tea, and Japanese lacquered ware and art goods; the imports include metal, woollen and cotton goods, raw cotton, and sugar.

On 1st September, 1923, the city was

almost completely destroyed by an earthquake and fire, which wiped out 80 per cent of the houses, killed many thousands of the inhabitants, and left about 300,000 homeless. The opportunity was taken to rebuild entirely; with extensive improvements to the docks and harbour Yokohama seems likely to recover its position as the first seaport of Japan.

YOM KIPPUR, *yom kip' oor*. The Jewish day of atonement. It is the tenth day of the seventh month (Tishri), and is observed as a day of fasting and worship. Modern observance includes, from sunset on the ninth day to sunset on the tenth, abstention from work, and services in the synagogue, in accordance with the ritual of tradition.

YORK, DUKES OF. This title was first conferred in 1385 by Richard II on his uncle Edmund of Langley, Earl of Cambridge (1341-1402), who had fought against the French. York was made Regent during Richard's Irish campaign of 1399, his feebleness and indecision making it possible for his nephew Bolingbroke to gain command of the country. Edward, his son, was made Duke of York in 1406, and proved his valour at Agincourt, where he was slain in 1415. As Earl of Rutland he had sealed the fate of Richard by betraying to Henry IV a purposed *coup d'état*.

Richard, Earl of Cambridge, brother of the 2nd Duke, was beheaded in 1415 for planning the accession of Edmund Mortimer, brother of his wife, Anne (see MARCH, EARLS OF). Their son Richard was restored to the dukedom by Henry VI. He was one of the more successful generals in the later years of the Hundred Years War and headed the war party against the Queen and the Duke of Suffolk. He was made Regent for a time during the reign of Henry. During the Wars of the Roses he was defeated at Wakefield and executed. On the accession of his eldest son as Edward IV the dukedom merged in the Crown.

The title has since been frequently conferred on the second son of the sovereign. It was borne by Henry VIII, Charles I, and James II, while their elder brothers were alive. Henry, grandson of James II and *de jure* Henry IX, also bore the title (see STUART, HENRY BENEDICT MARIA CLEMENT). Ernest Augustus (died 1728), brother of George I, and Edward Augustus (died 1767), brother to George III, were successively Dukes of York and Albany, and in 1784 George III bestowed the titles on his second son Frederick Augustus. This prince commanded two military expeditions, in 1793 and in 1799; their lack of success was not entirely due to him. He became Field Marshal and Commander-in-Chief in

1795 and vigorously attacked ancient abuses, unhampered by political associations and confident of his father's support.

In 1809 his valuable work was interrupted by a Member of Parliament and Militia Colonel named Wardle, who accused him of corruption and of traffic in commissions. York was acquitted by a large majority after an inquiry by the Commons and the verdict was undoubtedly just, but he resigned his office. In 1810 his brother became Regent and reappointed him.

The title has since been borne by King George V, on whom it was conferred after the death of the Duke of Clarence, and by King George VI until his accession.

YORK, HOUSE OF. A royal family of England which wrested the crown from the House of Lancaster during the Wars of the Roses. Richard, Duke of York, the founder of the royal line, was descended through his mother from the third son of Edward III, and through his father from Edward's fifth son. He claimed the throne, which was occupied by Henry VI, who was descended from the fourth son of Edward III. Richard's claims were recognized by the lords, and an act was passed providing that, upon the death of Henry VI, the crown should pass to Richard and his heirs.

Henry's queen, Margaret of Anjou, opposed this arrangement, as it disinherited her son. She summoned an army to support the House of Lancaster, and her adherents adopted the red rose as their symbol. Many ambitious nobles joined the cause of the white rose, that is, of the Yorkists, and the struggle between the two houses lasted thirty years. In the first conflict (1460), Richard was captured and beheaded, but in the following year, his son entered London and was crowned king as Edward IV.

In 1483 Edward was succeeded by his young son, Edward V, who, after a nominal reign of two months, was put aside by his ambitious uncle, the Duke of Gloucester. The latter then assumed the throne as Richard III. Later, Edward and his younger brother, Richard, were secretly murdered in the Tower by their uncle's order. In 1485 the usurper was killed in a battle with Henry Tudor, Earl of Richmond, a descendant of the House of Lancaster. Henry married the daughter of Edward IV, and so united the two royal families. He was crowned as Henry VII, the first of the great Tudor monarchs. See TUDOR FAMILY.

YORK. A city and county borough of Yorkshire with a population of 84,810 in 1931; one of the most interesting towns of Britain, retaining a large number of links with the settlement on its site before the Roman conquest. In A.D. 71 the Romans

occupied it and converted it into an armed camp, and later into the headquarters of one of the Legions. It became the base of the Duke of Britain who was the Roman plenipotentiary in charge of operations in the north-east. In A.D. 306 Constantine the Great was proclaimed Emperor in the city. Three hundred and twenty years later the first York Minster was built—a tiny wooden building in which the Saxon king Edwin was baptized on Easter Day. In 867 and

the Parliamentary army after a siege of six weeks following the Battle of Marston Moor. Since that period there has been peace, and, during the last hundred years, a very rapid expansion of population and industry, so that to-day the suburbs extend several miles outside the limits of the medieval city.

Industrial concerns include factories for the manufacture of cocoa and chocolate, optical instruments and foodstuffs. In



YORK

1. The Shambles. 2 York Minster from the Roman Wall. 3 Monk Bar. 4 The River Ouse and the Guildhall (left).

Photos: Taylor

1069 the city suffered disastrous sieges, the first at the hands of the Danes, the second at the hands of William the Conqueror. Twenty years later the new Minster was founded by William Rufus.

Since Norman times many events of national importance have taken place. 1190 witnessed the massacre of the Jews who formed a large proportion of the population of what was then an important trading town. In 1297 the parliament which decided on War with Scotland was convened at York, and in 1319 the citizens of York were defeated in a pitched battle outside the city walls by the Scots. In 1537 Aske, the leader of the Pilgrimage of Grace, was hanged. In the same year Henry VIII set up the Council of the North. In 1844 York surrendered to

addition, there are railway workshops where locomotives, as well as rolling stock, are manufactured, and many minor industries.

The most important building in the city is the Minster, of which the central tower is the largest in England. The earliest part of the present fabric dates from the thirteenth century and contains examples of most periods of architecture since that time. The stained glass is some of the most magnificent in the country; the Five Sisters Window being architecturally unique.

The walls of the city are unusually complete and are, in part, the original Roman fortifications, extended in the later Norman Period. The circuit is the largest in England with the exception of London. Four of the main gateways survive—Bootham Bar,

Monk Bar, Walmgate Bar and Micklegate Bar, in addition to two of the smaller posterns. There are many streets with gabled houses, particularly "The Shambles" and "Stone Gate." Clifford's Tower is a thirteenth-century keep raised on a Norman castle mound. Other interesting buildings include the Merchant's Hall—a fine seventeenth-century house containing the Great Hall of the fourteenth century and the Chapel of Holy Trinity of the early fifteenth century, St. Anthony's Hall—now a Blue Coat School—and the King's Manor—now the Blind School. St. Leonard's Hospital was traditionally founded by King Athelstan in connection with the Minster and was re-founded in the reign of Stephen. St. Mary's Abbey has the scanty ruins of a monastery founded at the end of the eleventh century, which was destroyed by fire and rebuilt in the thirteenth century.

York still retains its historic form of government, including a Lord Mayor, a Sheriff, a Bench of Aldermen and a City Council, the Lord Mayor retaining many of the titular privileges which in the Middle Ages gave him power as great as that of the Lord Mayor of London.

YORKSHIRE. A north-east maritime county, the largest in England. For administrative purposes it is divided into three parts—the East Riding with an area of 737,065 acres and a population of 169,692, the North Riding 1,357,871 acres and a population of 330,966, and the West Riding 1,625,058 acres and a population of 1,530,110 in 1931. These figures exclude the County Boroughs.

Physical Features. The river system of Yorkshire is its principal feature. Except for the Tees, the northern boundary of the county, and the Esk, all the Yorkshire rivers, the Derwent, Swale, Ure, Nidd, Wharfe, Aire, Calder, and Don, flow into the basin of the Humber and thence to the North Sea. With the exception of the Esk, Derwent, and Don these rivers rise in the Pennines, the range of mountains which bounds the county on the west, separating it from Lancashire. The Aire Gap divides the north Pennine moors from the south Pennines, and the highest points on the Yorkshire side are Mickel Fell (2591 ft.), Wharfedale (2414 ft.), Ingleborough (2373 ft.). Other high lands in the county are the Cleveland and Hambleton Hills in the north-east, and the chalk Wolds in the east. The Vales of York and Pickering compose the centre of the county, while to the north are the lowlands surrounding the estuary of the Tees, and in the south the low-lying lands round the wide mouth of the Humber. The coast line is rugged, with high cliffs,

Flamborough Head being the most prominent point. South of Flamborough the coastline suffers from erosion and large quantities of cliff disappear each year. Spurn Head, the most southerly point, is the termination of the flat lands to the north of the Humber.

Climate. It is impossible to generalize about such a large area. The rainfall is about the average for the whole country, though some of the westerly towns have rather more, while droughts are occasionally experienced on the Wolds. Bridlington has an average of 25½ in. yearly, Whitby 29, while Harrogate has 30½ and Ilkley 35. The mean temperature is also about the average, that of Scarborough being the highest, nearly 49 degrees. The sunshine figures are fair. In the north-west and on the Wolds snow is frequent between December and March.

History. We learn from the Roman writer Tacitus that this part of the country was inhabited by two Celtic tribes at the time of the Roman Conquest—the Parisii in the south, of whom little is known, and the Brigantes. The Brigantes were the largest tribe in Britain, and they stretched from the east coast to the west. It is thought that Isurium (Aldborough) was their capital. After a long and fierce struggle the Romans conquered them and made their headquarters at Eboracum (York) where the 6th Legion was stationed. Among Roman generals and Emperors who lived in York is numbered Constantine the Great. The Roman occupation of Yorkshire was chiefly military, and remains of Roman stations have been found at Danum (Doncaster), Legeolium (Castleford), Calcaria (Tadcaster), Olicana (Ilkley), and Cataractonium (Catterick). Apart from these there are remains of Roman villas in different parts of the county. It is also possible to trace the line of the Roman military road from Boroughbridge to Catterick, and the famous paved causeway over Blackstone Edge into Lancashire can still be seen. The Angles were the next invaders, and under them Yorkshire formed part of the Kingdom of Northumbria and was called Deira. Under Edwin, who was crowned king at York, Northumbria became the chief kingdom in England, and the Angles were converted to Christianity in 627 by Paulinus. It was during the Danish invasions that Deira was ravaged from York to the Tyne, and the Danish leader, Halfdan, in 876, settled at York and divided the surrounding country among his followers. Many Danish place-names are found in all parts of the county, and Danish kings ruled in York until Athelstan in 926 defeated Danes, Scots and Britons at Brunanburgh—

said by many to be Doncaster—and made Northumbria into an Earldom. In 1066 Harold defeated a new invading force of Norsemen at Stamford Bridge. The story of the Norman conquest of Yorkshire is one of risings followed by pillagings, burnings and general destruction, until in 1070 William I came north with an army and devastated the land between York and

the Stuarts is bound up with the growth of industry in the North and West Ridings, and the increasing importance of the towns.

At the present time the East Riding has three Parliamentary divisions and one borough, Hull, which returns four members, the North Riding, four divisions and one borough, Middlesbrough, which returns two members, and the West Riding, nine-



Durham. William I divided the land so ravaged and the other parts of Yorkshire amongst his followers, and during the next centuries the history of Yorkshire is that of the great feudal families—of their great castle building, domestic struggles and fights with the raiding Scots. The Wars of the Roses brought Yorkshire, whose emblem was the White Rose, into prominence again, and several battles were fought here, the chief being the Battle of Wakefield in 1460 when the Lancastrians were the victors, and Towton in 1461 when the Yorkists won. In the Civil War the town of Hull played an important part. Together with the clothing towns of the West Riding this port declared for Parliament, and the Royalist failure to capture it in 1643 was a great set-back. The history of Yorkshire since the time of

the Stuarts is bound up with the growth of industry in the North and West Ridings, and the increasing importance of the towns.

Agriculture and Industries. A great part of the county is moorland and unsuitable for cultivation, and is given over to sheep rearing and grouse moors. This applies particularly to parts of the North and West Ridings. Farming is the chief occupation of the East Riding where there are large arable farms. Until recent years nine-tenths of the land in the East Riding was under cultivation. Dairy farming has increased in recent years, especially near the industrial towns of the West Riding. In the Dales cheese making is carried on. The Vale of York is a rich grain-producing district. Yorkshire is also celebrated for its horses, the Cleveland district having given its name

to a special breed. The chief occupation of the industrial West Riding is the manufacture of woollen and worsted goods, of which it has practically a monopoly in England. On the borders of Lancashire there are large cotton mills. Sheffield, the largest town in the county, is noted for its steel works. Coal and iron are found in the Cleveland Hills, and in south Yorkshire coal-mining is the chief occupation. Fishing is an important occupation on the coast, and Whitby, Scarborough and Bridlington have their fishing fleets. Other occupations include chemical and glass manufacture, stone quarrying and brick-making, and the manufacture of sweets.

Transport. Two of the three main railway routes from London to Scotland serve Yorkshire, the L.M.S. line passing through Sheffield, Leeds and Hellifield, and the L.N.E. through Doncaster and York. The Great North Road enters the county at Bawtry, and passes through Doncaster, Ferrybridge, Boroughbridge, Catterick and Blackwell into County Durham. The Canals of Yorkshire are the Leeds and Liverpool Canal, the Aire and Calder Navigation, the Don River Navigation, the Barnsley Canal,

the Junction Canal, the Calder and Hebble Canal and the Huddersfield Canal. Hull, and Goole, on the River Humber, are the chief ports.

Antiquities. Evidence goes to show that the main settlements of prehistoric man seem to have been in the hill country. Flint implements have been found in quantities in the southern Pennines and also on Rombald's Moor near Ilkley. Remains of lake-dwellings have been discovered at Pickering. Three monoliths called "The Devil's Arrows," of which neither the date nor the purpose is known, stand at Boroughbridge, and stone circles are found near Settle and Slack. At Aldborough and Rudstone are remains of Roman pavements, those at the latter place being particularly fine. Yorkshire was very rich in monastic houses, having twenty-eight abbeys and numerous priories at the Dissolution in the reign of Henry VIII, and the ruins of many of these are still to be seen, notably Fountains, Rievaulx and Byland.

Chief Towns. York is sometimes erroneously supposed to be the county town. There is no county town of the whole county, the City of York being a county in



MIDDLESBOUGH OLD TOWN
The railway station is in the centre.
Photo: Middlesbrough Corporation



YORKSHIRE

1. Kilnsey Crag. 2. Flamborough Head lighthouse. 3. Butter Tubs Pass, near Hawes. 4. Low Row, Swaledale. 5. Scarborough Castle. 6. Wakefield, the building on the bridge is a chapel. 7. Richmond Castle. 8. Slip Top, Staithes.

• Fifth; George Long

itself. Each Riding has its own administrative centre, the East Riding at Beverley, the North Riding at Northallerton and the West Riding at Wakefield. Yorkshire towns dealt with separately in their alphabetical position are Barnsley, Bradford, Doncaster, Dewsbury, Halifax, Huddersfield, Middlesbrough, Northallerton, Rotherham, Sheffield, Wakefield, and York. Other important towns are mentioned below—

Bridlington. Seaport and holiday resort on the Yorkshire coast. The Priory Church founded in 1119 was an Augustinian house. The harbour has two stone piers, and, sheltered by Flamborough Head 6 miles to the north, is the only safe anchorage on the Yorkshire coast during northerly gales. Population (1931) 19,705.

Pontefract. A town in the West Riding of Yorkshire, standing on high ground near the junction of the Rivers Aire and Calder. In former times it was known as Pomfret, and its Castle was the prison of many political offenders. Richard II died there. During the Wars of the Roses it was a Lancastrian stronghold. The Castle grounds are now a public park. The church, All Saints, was damaged by the Parliamentarians in the Civil War. The Town Hall dates from 1785. The town is the home of "Pontefract Cakes," a sweetmeat made of liquorice. Population (1931) 19,057.

Redcar. The most northerly seaside resort of Yorkshire. It has fine firm sands, a long pier and esplanade and a bracing climate. There is also a racecourse. Population (1931) 20,159.

Richmond. An old town in the North Riding of Yorkshire, situated on a hill above the River Swale. The market place is the largest in Yorkshire, and retains its medieval cobblestone paving. Some of the remains of the Castle date back to the eleventh century, for the Great Hall shows stonework of 1071. The massive Norman keep was built in 1165. A thirteenth-century church tower also remains. Population (1931) 4769.

Skipton. A busy industrial town in the Craven district of the West Riding of Yorkshire with an agricultural market. It has woollen, and sewing cotton mills. The Castle dates back to Norman times, but little of that period remains. The dungeon and round towers of later structures still remain. It belonged to the Clifford family. Skipton is an important road and rail junction, the routes from Lancashire and the west meeting those from Kendal and the north, and continuing together into the heart of the West Riding. Population (1931) 12,461.

Selby. An old town standing on the River

Ouse in the West Riding of Yorks. The Benedictine abbey of St. Mary and St. German was said to be the most perfect monastic church in Yorkshire. It escaped destruction at the Dissolution, and although a fire in 1906 did a great deal of damage, much of it has been restored. Among the more notable features are a fine east window, and a Norman doorway in the north porch, and the remains of a tithe barn 313 ft. long. Population (1931) 10,064.

YORKSHIRE TERRIER. Originating in Yorkshire, this breed became standardized and in 1886 the name was sanctioned by the Kennel Club. He is a long-coated toy terrier; adult dogs may weigh only 3 lb. The coat, perfectly straight, glossy like silk, hangs straight and evenly down each side, the parting extending from the nose to the end of the tail. The somewhat larger and hardier dogs make delightful pets. They are bright, intelligent and plucky. The small V-shaped, semi-erect or erect ears are covered with short hair of a deep rich tan. The head is well covered, the hair of a rich golden tan often hiding the eyes. The colour is dark steel blue from back of head to root of tail, the tail—cut to medium length—of a darker blue, rich golden tan on legs and chest. Puppies are born black and short-coated.

YOSHIMITO, *yō' she he tō*, HARUNOMIA (1879-1926). Former Emperor of Japan, succeeding his father Mutsuhito, who died in 1912.

From his youth he was trained to be a constitutional monarch, the first of all the Japanese emperors who was not born to rule with absolute power. He married his cousin, Princess Sada-ko, in 1900. Of three children, the oldest, Hirohito, succeeded to the throne at Yoshihito's death, on Christmas day, 1926.

YOUNG, BRIGHAM (1801-1877). Second president of the Church of Jesus Christ of Latter Day Saints (see MORMONS). He was of American birth and spent his early life on his father's farm. Later he formed a friendship with Joseph Smith, founder of the Mormons, and was made an elder of the church.

It was due to Young that the Mormon sect was not dissipated during the period of ill feeling against it which began in 1844. Under his leadership a migration was begun to the West and the sect firmly established in Utah.

YOUNG MEN'S CHRISTIAN ASSOCIATION. A world brotherhood which seeks to minister to the needs of boys and young men, to meet the complex problems and conditions of present-day life, and to give opportunities for greater self-development in body, mind, and spirit.

It had its inception in a small room of the drapery establishment of Hitchcock & Rogers in St. Paul's Churchyard in London, when George Williams, a young clerk of 19, and eleven of his friends formed an association, so that they might help each other in putting into active practice the Christian principles in which they believed. Led by a desire to spread the benefits obtained from these Christian contacts, George Williams and his eleven friends met on 6th June, 1844, and set up what they agreed to call the "Young Men's Christian Association." The movement grew rapidly, and by 1848, quarters containing a library and reading and rest rooms were maintained in London. Associations were founded in Montreal on 25th November, 1851, and in Boston on 29th December. The distinctive feature of the organization is the combination of religious and social activities. There are now nearly 1,700,000 Y.M.C.A. members in fifty-six different countries.

YOUNG PLAN. A scheme for war debt payments rendered necessary by the failure of the Dawes Plan. It owes its name to Owen D. Young, an American financial expert who was largely its author. See WAR DEBTS.

YOUNG PRETENDER. See STUART, CHARLES EDWARD.

YOUNG TURKS. A reform party in Turkey, the members of which brought about the revolt of 1908-1909 and forced Abdul-Hamid to resign. See TURKEY.

YOUNG WOMEN'S CHRISTIAN ASSOCIATION. The Y.W.C.A. developed from two separate groups in England which originated at about the same time. One, the Prayer Union, under the leadership of Emma Roberts, began in 1855 as a Saturday-evening prayer society, and later, when branches were established, they took the name Young Women's Christian Association, and patterned their organization after the Y.M.C.A. The other group was founded the same year by Lady Arthur Kinnaird, and was called the Girls' Friendly Society. Boarding homes for girls were soon established, besides the social, recreational, and religious features which to-day characterize the organization. In 1877 the two groups united. The Y.W.C.A. is established in sixty countries.

YPRES, *o' pr'* (called *wipers* by the British soldiers). See BELGIUM.

YPRES, JOHN DENTON PINKSTONE FRENCH, EARL OF (1852-1925). Sir John French, to use the title by which he is best remembered, was a descendant of military and naval officers. He began his career as a midshipman but left the Navy in 1870. Four years later he became a Hussar officer.

He served in Egypt and the Sudan, and in 1889 was in command of the 10th Hussars. As a Major-General in the South African War he took part in important engagements and won fame as a brilliant cavalry leader. He commanded the Cavalry Division under Lord Roberts. During the years of peace he held high command; in 1912 he was appointed Chief of the Imperial General Staff and in 1913 he was made a Field Marshal.

In 1914 he commanded the first British Expeditionary Force. The British were flung in on the French left and in the Retreat from Mons fought one of the most confused and glorious rear-guard actions ever known. The Battle of the Marne checked the German advance but was followed by the German attack on the Channel ports and the first Battle of Ypres. Trench warfare was by now established. In 1915 came repeated but costly attacks on the German lines and the realization that the British supply of munitions was inadequate. In September an offensive at Loos was brilliantly successful. Soon after this French was recalled to England and replaced by Sir Douglas Haig. In his courage and his care for his men he had represented some of the best traditions of the British Army.

On his return to England he was created Viscount French of High Lake. From 1918 to 1921 he served as Lord Lieutenant of Ireland, during a period of great difficulty, when a Sinn Féin assembly proclaimed an Irish Republic in Dublin and a savage war was raging. On his retirement he became Earl of Ypres.

YUAN SHIH-K'AI, *yuahn' she ki'* (1860-1916). A statesman of China and the first President of the republic established in 1912. He was born in the province of Honan, of the Chinese rather than the dominant Manchu race. In 1882 he went to Korea (Chosen) and became Chinese Commissioner there, returning home at the outbreak of the Chinese-Japanese War of 1894-95. He had a large part in the reorganization of the Chinese army and navy, and during the Boxer troubles of 1899-1901 was distinguished for his work on behalf of the foreign legations.



LORD FRENCH
Photo U. & L.

When the revolution against the Manchu rulers broke out in October, 1911, Yuan Shih-K'ai was made head of the imperial forces, and a few weeks later became Prime Minister. When a republic was demanded, Yuan Shih-K'ai was elected to the Presidency.

As President. In order that old traditions of his land might not be destroyed, he ordered the restoration of the old religion, the worship of Heaven and Confucius.

Yuan Shih-K'ai was offered the throne at a time when Japanese aggression was causing further unrest, but at first declined, as official etiquette demanded. When it was offered the second time, as etiquette also demanded, his acceptance followed. Three different times the coronation ceremonies were postponed. In March, 1916, it was definitely announced that China would remain a republic. By that time, many of the provinces had declared their independence of the central government, and the Kuomintang (radical party) leaders established a new provisional government at Canton. Yuan's death occurred while he was still engaged in restoring order. Some accounts attribute his premature demise to poison.

YUCATAN, *yu ka tahn'*. A peninsula of Central America, forming the extreme south-eastern part of Mexico. Its area is about 25,000 sq. miles.

Having a hot and dry climate, Yucatan furnishes ideal conditions for growing henequen. Modern methods and machinery are used in its cultivation, and, although the plantations of Yucatan furnish yearly 200,000,000 lb. of fibre to American markets for the manufacture of rope and twine, less than half of the best henequen-producing lands are cultivated, because of the scarcity of labour.

In 1930 the population was about 390,000. Mérida (110,000) is the capital city.

YUGOSLAVIA, *yu' go slah' via*, formerly known officially as the **KINGDOM OF THE SERBS, CROATS, AND SLOVENES**. One of the States built upon the ruins of the Austro-Hungarian Monarchy. The military collapse of the Central Powers in 1918 was followed by a revolution in Austria-Hungary, in the course of which the southern Slav peoples of the Dual Monarchy declared their independence, and voted for the union of the Yugoslav provinces of the Austro-Hungarian Monarchy with the kingdom of Serbia to form the Kingdom of the Serbs, Croats, and Slovenes. The united country was commonly called Yugoslavia, a name meaning "State of the South Slavs," *yug* being the Slav word for *south*; in 1929 it became the official name of the kingdom.

Position and Area. Yugoslavia lies on the north-east of the Adriatic Sea with Italy on the north-west and Austria and Hungary on the north; Rumania and Bulgaria are on the east, and Greece and Albania are on the south. The country has a total area of 95,558 sq. miles. It includes the areas formerly known as Slovenia, Croatia, Dalmatia, and Bosnia, as well as the former kingdom of Montenegro.

The People. Yugoslavia represents, primarily, a union of South Slav peoples. Yet, out of a total population of 14,730,000 (1934), not over 83 per cent are Yugoslavs. The minority populations include some 505,000 Germans, 467,000 Hungarians, 439,000 Albanians, 231,000 Rumanians, and smaller numbers of Slovaks and Ruthenes, Italians, Turks, Spanish Jews, and gypsies. The dominant language spoken is the Serbo-Croatian, but the Slovenes have a dialect of their own, and the languages of the foreign nationalities are, of course, in use. Though the Serbs and Croats speak the same tongue, the Serbs use a form of the Slavonic alphabet and the Croats employ Latin characters.

Religion. Roman Catholicism is the faith of most of the Slovenes, Croats, and Dalmatian Slavs, while the Serbs and Montenegrins belong chiefly to the Greek Orthodox Church, which claims some 47 per cent of the total population. In general, the Roman Catholic Yugoslavs are Western in their culture, traditions, and outlook, while the Serbs and Montenegrins show the influence of centuries of Turkish domination. Large numbers of the Serbo-Croats of Bosnia are Mohammedans. Mohammedanism has, in fact, over a million adherents. There are also about 231,000 Protestants and 68,000 of Jewish faith.

Education. Elementary instruction is compulsory, and free primary schools are maintained by the government. There are three universities. The largest, at Belgrade, is attended by over 6000 students. Most of the peasants cannot read or write, but illiteracy is decreasing.

Physical Features. Yugoslavia is a land diversified by rugged mountains, deep valleys, winding rivers, and inland plains. The Dalmatian coast is deeply indented, and is fringed with innumerable islands. A narrow belt along the coast has the hot, dry summers and mild, wet winters typical of Italy. Interior Dalmatia is largely mountainous, being traversed by the Dinaric Alps, which form a great barrier on the east between the province and Bosnia. The western ranges of these mountains are part of an extensive limestone plateau known as the Karst, a bleak, inhospitable region extending from Western Slovenia into Montenegro, and



YUGOSLAVIA

1. Susak. 2. Stradun-Orlando, Dubrovnik. 3. The bazaar at Sarajevo. 4. Girls of Koniakole in native costume. 5. Town walls of Dubrovnik. 6. Hotel Esplanade, Zagreb.

Photos. Government of Yugoslavia



RIVER VALLEY IN YUGOSLAVIA

Photo: Government of Yugoslavia

through parts of Croatia and Bosnia-Herzegovina.

North-west of the Karst rise the eastern ranges of the Julian Alps and the valleys of the Drave and the Save. The Save, which enters the Danube at Belgrade, and the Morava, which joins that great river 30 miles east of the city, outline a great triangular basin that expands northward upon the fertile lowlands of the Banat country, and narrows southward into the Vardar basin. The northern plains country and associated river valleys have a typical continental climate with warm summers that are moderately rainy, and with cold winters. These are the most important areas of cultivation.

Southern Yugoslavia is almost wholly mountainous.

Agriculture and Forestry. About four-fifths of the people in Yugoslavia are engaged in some form of agriculture. About 56 per cent of the land is cultivated. Serbia, Croatia, and Slavonia are best cultivated. Wheat and maize are the chief cereals with a good deal of barley, oats, and rye. Some hemp is cultivated and some vines, tobacco, and olives. Horses, cattle, pigs, goats, and poultry are all important. Yugoslavia is normally an exporter of food.

Mining and Manufacture. There are considerable mineral deposits in Yugoslavia awaiting development. Iron is mined to some extent in Bosnia, which has almost unlimited deposits. Lignite (brown coal)

is widely distributed, and is mined in Bosnia and Serbia, but coal for manufacturing purposes has to be imported. Serbia is the chief centre of copper production, and has a small yield of iron, chrome and antimony. Lead is mined in Slovenia.

Manufacturing has been limited by inadequate transport facilities, scarcity of fuel, and lack of capital. As these defects are overcome, industry will develop along broader lines. In Vojvodina, where wheat is a leading crop, flour-milling is relatively important. The manufacture of iron and steel is carried on in Slovenia and Bosnia, and furniture-making in Croatia. Carpet and rug-weaving is a typical Serbian enterprise. Other Yugoslav industries are saw-milling, tanning, cotton-spinning and weaving, sugar manufacture, and brewing, wine-making, and distilling.

Transport and Commerce. Most of the railways are state-owned. There is direct communication by rail with Vienna and Budapest, and through the Vardar valley with the Greek port of Salonika, where a free Yugoslavian zone has been established by Greece.

Yugoslavia has two Adriatic ports that have developed rapidly since the final territorial arrangements with Italy. In Croatia is Susak, the suburb of Fiume, with good rail connections. Farther south, and correspondingly nearer to Mediterranean and transatlantic markets, is the Dalmatian town of Split (Spalato). It also has through rail connections.

Interior Yugoslavia, which has timber, grain, livestock products, and minerals for export, cannot get them to the coast. Hungary is within easy reach, but itself produces most of these commodities. The rocky Karst and rugged Alps impose a barrier to transport that the present narrow-gauge and discontinuous lines cannot overcome, especially in the conveyance of bulky cargo.

Principal Cities. Belgrade, the capital (with Semlin), is also the largest city. The second in size is Zagreb (or Agram). Sarajevo in Bosnia and Cetinje in Montenegro, are interesting as historic capitals. These four cities are described below—

Belgrade, since 1929 **BEOGRAD**, is a city on a promontory formed by the confluence of the Danube and the Save. No other European fortress has witnessed more battles than have been waged around the walls of Belgrade. In ancient days, it was a strong outpost against the advancing Turks, who named it "the home of wars for the faith." It was not until 1866 that the city was finally freed from the unwelcome Turkish garrison.

Modern Belgrade dates from its evacuation by the Turks. The city shows a mixture of East and West, with the latter speedily gaining.

Belgrade was occupied by the Austrians from October, 1915, until the end of the war. In 1929, Semlin, across the Danube, was added to Belgrade, to form an administrative district, as the capital of the country. Population of Belgrade, 238,775 (1934).

Zagreb, *sah' greb*, is the leading financial and commercial city of Yugoslavia. Here, in October, 1918, the Yugoslav National Council assembled and voted a resolution in favour of an independent State (see *History*, below). Zagreb has a beautiful situation in the mountains of Croatia, 2 miles east of the Save. Population, 185,581 (1934).

Sarajevo, *sah' ra yay' vo*, the capital of

Bosnia under Austrian rule, lies 122 miles south-west of Belgrade. *Sarajevo* means "city of palaces," and was applied in honour of the palace built in the fifteenth century by one of its Mohammedan rulers. Old cypress groves, curious wooden houses, scores of mosques with their glittering minarets, and above all, the great bazaar, make it still seem more Oriental than European. It is a busy trading centre. Silks, metal filigree work, rugs, and embroideries are produced. It was in Sarajevo that Francis Ferdinand, heir to the Austrian throne, and his wife were assassinated in June, 1914. Population, 78,182 (1931).

Cetinje, *tset' en yay*, formerly the royal capital of Montenegro, is situated in a barren and stony region, 2100 ft. above the Adriatic Sea, about 10 miles inland, and is little more than a village. Trade and manufacturing are unimportant. The city was founded in the fifteenth century; it was repeatedly conquered and sacked by the Turks. Population, 6367 (1931).

The Birth of a New State. The revolutionary movement within the Austro-Hungarian Monarchy made rapid progress after the German advance in the spring of 1918 had been checked. As early as August in that year, a Slovene National Council in Laibach, the capital of Carniola, was assuming the authority of an executive government, and the way was thus prepared for the assembling of the Yugoslav National Council at Zagreb in October. In this assemblage there were representatives from Croatia-Slavonia, Bosnia-Herzegovina, Dalmatia, Istria, and the Slovene territory. The resolution in favour of a union with Serbia and the formation of an independent State was voted on 9th October. In the meantime, the National Council took over the administration of government. On 1st December, Prince Alexander, regent of Serbia, accepted



WOODCARVING SPLIT (SPALATO) DEPICTING THE NATIVITY
Photo: Government of Yugoslavia

the invitation of the Council to assume the regency of all the provinces.

Montenegro, meanwhile, had signified its desire to become a part of the kingdom when, on 26th November, its National Assembly made a formal declaration in favour of union and repudiated King Nicholas and the court party. Belgrade was selected as the capital of the new State, and a provisional Parliament held sessions there for two years. Elections to a permanent assembly were held in November, 1920, and on the



ASSASSINATION OF KING ALEXANDER OF
YUGOSLAVIA AT MARSEILLES IN
OCTOBER, 1934
Photo: Topical

following 28th June, Prince Regent Alexander, promising to uphold the Constitution of 1921, became King Alexander I.

The Constitution of 1931 provided for a national assembly of two chambers, a Senate and a Chamber of Deputies (Skupshchina). The Senate consists of a variable number of members, of whom half are elected and half are appointed by the king. The Skupshchina is composed of deputies elected for four-year terms, on the basis of proportional representation. Provision also was made for a Cabinet.

Subsequent History. The delay in establishing a permanent form of government was due partly to the complicated frontier lines that required settling. However, by 1921 all of the boundaries of the new State had been fixed by decisions of the Peace Conference or by treaty, except those in which Italy was particularly interested. The dispute centred about the Adriatic port of Fiume, which Yugoslavia needed as an outlet for trade, and which Italy demanded because of a majority Italian population in the city proper, though the suburb of Susak was dominantly Slav. The Treaty of Rapallo, signed by the two countries in 1920, failed to bring about a settlement, for, though Fiume was made an independent State,

Italy nullified the agreement by taking forcible possession of the city. Not until January, 1924, after Mussolini became dictator in Italy, was the dispute closed by mutual acceptance of the "Pact of Rome." Fiume was given to Italy, but Yugoslavia gained Susak, with Port Baros and the intervening delta, and retained possession of Dalmatia, with the exception of Zara and three coast islands.

For years after the adoption of the Constitution of 1921, Yugoslavia struggled with internal political discord. There were about a dozen different political parties with representatives in Parliament, and a strong majority for the government was very difficult to secure.

On 6th January, 1929, by royal proclamation, King Alexander abrogated the Constitution that he had sworn to uphold, and dissolved Parliament, the land assemblies, and the municipal councils. His proclamation was accompanied by four ukases, or royal edicts, designating the king as holder of all the powers in the State, with authority to make new laws and to nominate State functionaries and Ministers responsible only to the king. Laws to suppress all criticism of the new order were promulgated.

Former leaders of all three national parties obtained appointment to the Cabinet. At first, the Croats welcomed the king's *coup d'état*, but, as time went on, they began to assert that the dictatorship was pro-Serbian and against the interests of the Croats and Slovenes. By the autumn of 1929, they were demanding total autonomy, but other changes had been planned by the dictators at Belgrade, and on 4th October, 1929, the Kingdom of the Serbs, Croats, and Slovenes passed out of existence, and was officially replaced by the State of Yugoslavia, comprising nine semi-independent States known as *banovinas*, each governed by a *ban*, or governor.

The New Yugoslavia. This drastic change in administration was the result of a decision to grant partial autonomy to various districts of the kingdom in order to allay the friction which had been increasing among the three dominant races of the population.

The dictatorship failed to secure the co-operation of the various groups, of which the population is composed. Finally, on 3rd September, 1931, Alexander published a new constitution. The criticism was made that this constitution was merely a screen behind which the former dictatorial policies were to continue. Subsequent events proved the truth of this, for only such candidates as promised to support the National Party were permitted to seek office in the election held 8th November, 1931. King Alexander



KOTOR

Photo: Government of Yugoslavia



DUBROVNIK (RAGUSA)

Photo: Government of Yugoslavia

I was assassinated at Marseilles on 6th October, 1934, and succeeded by his son Peter II, born in 1923. Three Regents were appointed, the chief being Prince Paul, brother of the late king. See also SERBIA.

YUKON, *ü'kon*. Territory which occupies the north-west corner of the Dominion of Canada. Yukon has an area of 207,076 sq. miles. Until the discovery of the Klondike goldfields in 1896, this vast region was practically unpopulated, but in 1901 the census showed a total of 27,219 people. In 1931 it was only 4230. The principal settlements are Dawson, the capital city, with 828 inhabitants, and Whitehorse, having 541.

Physical Characteristics. Practically the whole of Yukon falls within the Rocky Mountain, or Cordilleran, belt, but between the various mountain ranges are fertile plains and valleys. Only in the south do the mountains rise to great heights. There, almost on the Alaska boundary, is Mount Logan, 19,850 ft. high, the loftiest peak in Canada. The Rocky Mountains, whose main chain forms most of the eastern boundary, are the watershed between the Yukon and Mackenzie Rivers, but in places are scarcely more than a range of low hills. Considered as a whole, the surface of the Yukon is a rolling, elevated plain, from 2000 ft. to 3000 ft. above the sea, and broken by many river valleys and mountain ranges. The principal physical feature is the Yukon River, whose tributaries and branches penetrate almost every corner of the territory except the extreme south-east, which is drained by the Liard River into the Mackenzie River system.

The climate is subject to wide extremes of heat and cold. The winter temperature is sometimes as low as 60° F. or 70° F. below zero. The summer is short, but the many hours of daylight, about twenty every day at Dawson, make it possible to grow garden vegetables.

Mineral deposits include gold, silver, lead, copper, iron, and coal, the two first-mentioned being most valuable. Important discoveries of gold were made on Forty-Mile Creek in 1886, but the discovery of the

marvellously rich Klondike fields in 1896 brought 40,000 prospectors into the Klondike. Dawson was founded in the same year, and in 1898 Yukon was separated from the North-west Territories. It is governed by a comptroller, assisted by a council of three elected members. Yukon is represented in the Dominion Parliament by one member.

Natural Resources and Future Possibilities. Since the exhaustion of the rich placer deposits, hydraulic and vein mining have been the rule. The gold output reached its highest point in 1900, when the total amounted to over £4,000,000, but it now averages less than £150,000 a year. Recent development of extensive silver and lead mines has yielded an average production which exceeds that of gold.

Agriculture and manufacturing are also carried on, but only for local purposes. Great numbers of fur-bearing animals and big game are found, and there are several fox farms, the basis of an important industry.

The Yukon River, in summer, is the chief line of communication. There are 58 miles of railway.

YULE, *yool*. An old name for Christmas tide, derived from an Anglo-Saxon word used to designate the months of December and January, one of which was called the "former Yule," the other the "after Yule." In pre-Christian days, in Scandinavian countries, festivals were held at this turning point of the year, and these later became associated with the Christmas celebrations.

YUNNAN. An inland province in the south-west of China with an area of 146,714 sq. miles and a population of over 11,000,000. It is a rugged plateau at an average elevation of 6000 ft. Plain areas are few but fertile. Climate on the whole is temperate with heavy rain in summer. Rice is the summer crop, and wheat, opium, and oil seeds are the winter crops. Tobacco, hemp, tea, and locust beans are also grown. Copper and tin are mined and there is much unexploited mineral wealth. Yunnanfu (population 180,000) is the chief town with railway connection with Hanoi and Haiphong in French Indo-China.

THE WORLD BOOK

Zz

Z. The twenty-sixth and last letter in the English alphabet. It was derived from the Phoenician, through the Greek and Latin. The Phoenician name for the character, which was the seventh in their alphabet, was *zayin*, meaning *dagger*, and

t

the symbol was a rough sketch of the handle and part of the blade of that weapon. The Greeks called the letter *zeta*, and changed it to the form of the modern capital Z; the Romans, when they adopted it, placed it at the end of the alphabet. It was only in the fifteenth century that the *zed*, as it was called, came to be used in English. Originally, it was a compound sound, like *ds*, but has entirely lost that character and taken on the soft "buzzing" sound. In this value it is often replaced by *s*, as in *rose*, or by *ss*, as in *dissolve*.

ZAGREB, *zah' greb*. See YUGOSLAVIA.

ZAMBEZI, OR **ZAMBESI**, *zahn bay' zi*, or *zam be' zi*, RIVER. A river of Africa, surpassed in size only by the Nile, the Niger, and the Congo. It rises close to the border between Belgian Congo and Angola, 5000 ft above the sea, emptying into the Mozambique Channel, an arm of the Indian Ocean. The total length of the stream is about 2200 miles; it has many tributaries, and the area drained by the whole system is over 500,000 sq. miles.

The river is navigable for steamers from the sea to the Kebrabasa Rapids (400 miles), and but for those rapids might be ascended almost to the rapids below Victoria Falls,

a cataract which has a greater volume than the Niagara Falls. The various navigable stretches, including the navigable waters of the tributaries, total 4000 miles.

ZANGWILL, *sang' wil*, ISRAEL (1864-1926). A British writer, of Jewish parentage, he was born in London and edu-



ISRAEL ZANGWILL
U. & U.

cated at the Jews' Free School, Spitalfields. Later he graduated with honours from Lon-

don University. In 1888 he published a romance, *The Premier and the Painter*, and in 1892 appeared his *Children of the Ghetto*, the first of several works of fiction representative of Jewish life and character.

Later works are: *Ghetto Tragedies*, *They that Walk in Darkness*, and *The Mantle of Elijah*. In his *Dreamers of the Ghetto*, Spinoza, Heine, and other Jewish men of genius are portrayed. Others of his works are: *Without Prejudice*, a collection of essays contributed to the *Pall Mall Gazette*; *Merely Mary Ann* and *The Melting Pot*, plays that have been very popular. *We Moderns* is a more recent drama.

ZANZIBAR, *zahn zi bar'*, or *zan' zi bar*. An island and British protectorate of East Africa, off the coast of Tanganyika Territory. It has an area of 640 sq. miles and a population of 235,428 (1931) including the island of Pemba (area 380 sq. miles).

The protectorate is nominally governed by a sultan, under the supervision of the British Colonial Office, with a British "Resident." The present sultan, born in 1879, has been sustained in his position by Great Britain since 1911. In 1926 executive and legislative councils were established, the former is presided over by the sultan, the latter by the British Resident.

The population is mixed, a Bantu-speaking race being probably the original inhabitants. Arabs, Parsees, Hindus, Swahili, and natives of all parts of East Africa are found in Zanzibar; the Europeans number about 300.

mostly British. The port of Zanzibar is the only large town, with a population of 45,276.

The exports include cloves, copra, copal



STREET IN ZANZIBAR
Fax

gum, hides, and ivory. The bulk of the trade is with India. The dominant religion is Mohammedanism.

ZEALAND, OR SEELAND, 'ze' land, ISLAND. See DENMARK.

ZEBEDEE. Father of the Apostles James and John. See APOSTLES.

ZEBRA. A horselike animal found wild in Africa, in the mountainous parts of Cape Province in the south and in the Sudan in the north. Zebras are distinguished from all other members of the horse family by their peculiar markings, parallel black stripes on a grey-white or cream-coloured ground, arranged in designs of almost geometric precision.

There are three well-recognized species, differing slightly from each other in size and proportions, and in colour and markings. It is possible to train zebras to work in harness, but they are not easily subdued.

Scientific Names. Zebras belong to the family *Equidae*. The three species are, respectively, *Equus zebra*, *E. burchelli*, and *E. grevyi*.

ZEBU. The former name of Cebu (which see).

ZEBU. One of the domestic cattle of India, used for ploughing and also as beasts of burden. Zebus have convex foreheads, drooping ears, short, backward-pointing

horns, and a huge, fatty lump on the shoulders. The usual colours are grey and cream. Some white bulls, called *Brahmany*, are held sacred by the Hindus.

Scientific Name. Zebus belong to the family *Bovidae*. Their scientific name is *Bos indicus*.

ZECHARIAH, *zeh a ri' a*. A Jewish priest and prophet, author of the first eight chapters of the book in the Old Testament which bears his name. Zechariah lived during the reign of Darius, the Persian conqueror, about 521 B.C. He was born in Babylonia during the Captivity. He was a leader in the restoration of the Temple and city of Jerusalem, and in the return of the Jews from the Babylonian Captivity. He is credited with being a poet, and was associated with Haggai in the authorship of several of the *Psalms*, but the book that bears his name is written in the ordinary Hebrew prose.

ZEDEKIAH, *zed e hi' a*. The last king of Judah of the line of David, who became king in 597 B.C. Subsequently, Zedekiah broke his oath of allegiance to Nebuchadnezzar, and joined the forces of Egypt against him. Jerusalem was captured by Nebuchadnezzar in 586 B.C., and the leaders of the Jews were taken captive. Zedekiah's eyes were put out, his sons were killed in his presence, and he was carried in fetters to Babylon, where he died. Two false prophets also bore the name.

ZEELAND, PAUL VAN (born 1893). Prime Minister of Belgium. He entered the field of active politics in 1934. Thus his rise to leadership has been remarkably rapid. His pre-Parliamentary experience was in finance



Photo: Cherry Kearton

and he was Vice-President of the National Bank at Brussels. He is leader of the Catholic Party which, with the Liberals, has formed a coalition government with the

Socialists in official opposition. It is the Rexists, a Fascist party, who have provided M. Van Zeeland with his most difficult problems. In 1937 he gained an election victory against their leader, M. Degrelle.

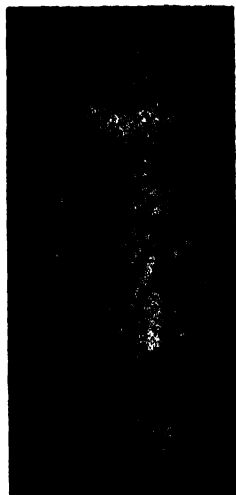
ZENANA, *zē nah' na*. The name given in India to that part of the house which is set apart for the women. All its windows look out upon a court affording no glimpse of outside life.

ZEND-AVESTA, *a ves' ta*. The bible and prayer book used by the Parsees, a religious sect which follows the teachings of Zoroaster. The book is only a small part of the original sacred writings of the Zoroastrians. A collection of writings similar to the Old Testament, it is of historical importance, for it contains material on the beliefs and customs of ancient Persia.

ZENITH: A term in astronomy denoting the point in the heavens directly over the head of the observer. It is the exact opposite of *nadir*, which is the point directly below; the zenith, the centre of the earth, and the

nadir are in one straight line. *Zenith* is used in a figurative sense in literature, to denote the highest attainable point.

ZENO. A Greek philosopher, born at Citium on the island of Cyprus. Although none of his writings has survived he is known to have taught doctrines similar to those of the Stoics, and is generally credited with the foundation of that school of thought. Most of his life was spent in Athens where he opened a school



ZENO

Photo: Anderson

of philosophy, known to posterity as the Painted Porch.

ZENOBIA, *ze no' bia*, called "the Queen of the East." She was the ruler of the ancient city of Palmyra in the Arabian desert, succeeding her husband, Odenathus, at about A.D. 267. She was a woman of great virtue as well as beauty, and ruled with wisdom and tolerance. King Odenathus had pledged the loyalty of Palmyra to Rome, but Zenobia, who was encouraged to rebel against Rome by her adviser, Cassius Longinus, aspired to rule over an independent kingdom. She freed large Asiatic

possessions from Roman domination, and attempted to extend her power over Egypt. She successfully resisted the armies of two emperors, but was defeated by Aurelian in 272.

ZEPHANIAH, *zef a nī' a*. A Hebrew prophet whose name has been given to the ninth book of the Minor Prophets. It is inferred that he lived and wrote during the reign of Josiah in Judah. His book pronounces a doom on the world, and especially on Judah, for its idolatry, and foretells the destruction of Nineveh. Zephaniah is said to have been a great-grandson of Hezekiah.

ZEPHYRUS, *zef' i rus*. In mythology, the west wind, one of the sons of Aeolus. See **AEOLUS**.

ZEPPELIN, *tsép' s leen*, FERDINAND, COUNT VON (1838-1917). A German inventor,

born at Constance, Baden. Much of his life was spent in the army from which he retired in 1891 with the rank of General. His early experiments with a dirigible balloon were successful, and in 1892 he made a flight from Berne to Lucerne. The first airship of the type named after him was built in 1900; it remained aloft for 20 min., but was wrecked in landing. Repeated experiments further perfected Zeppelin's skill, and in 1913 the seventeenth airship he had constructed, called the *Saxon*, made a trip from Baden-Baden to Vienna in about half the time required for the journey by train. The principles on which the construction of such dirigibles as the Graf Zeppelin has been based are extensions of those laid down during his lifetime.



COUNT VON ZEPPELIN

Photo: U. & U.

ZEUS, *zūse*. The chief god in the Greek pantheon, corresponding to the Roman Jupiter, to whom many of his attributes were transferred, and with whom he was identified in later Roman mythology. See **JUPITER**.

ZINC, OR **SPELTER**. A bluish-white metallic element, or metal, the ores of which have been known from ancient times. *Spelter* is the name usually given the commercial product. Zinc was first recognized as a metal by Paracelsus in 1520, but its practical use as such dates from the nineteenth century. It is rarely found in the native state, but its ores are widely distributed.

The principal zinc ores are *sphalerite*, the sulphide; *smithsonite*, the carbonate; *calamine*, the hydrated silicate; *willemitite*, the anhydrous silicate, *zincite*, the oxide; and *franklinite*, the oxide of iron, manganese, and zinc.

The ores used for commercial production of zinc occur chiefly in Poland, Belgium, Canada, France, Australia, and the United States.

Zinc resembles lead, but is much harder. However, if heated to 212°–300° F., it softens and becomes malleable and ductile. Under the action of moist air, it forms a self-protective coating of tarnish. Zinc is strongly charged with positive electricity. Its chemical symbol is Zn.

Uses. Large quantities of zinc are used in galvanizing iron and steel, to make them rust-proof. Because of its resistance to corrosion, sheet zinc (spelter) is used for roofs and gutters and tank linings. There is also an extensive use of zinc in the making of electric batteries. This metal is readily alloyed with copper to form brass, with copper and tin to form bronze, and with copper and nickel to form German silver. It is also employed in the process of zinc etching for making plates used in the reproduction of drawings in printing.

ZINC ETCHING. A process of making a plate from zinc, for the reproduction of line drawings and lettering. The drawing is made with India ink on white paper, and a photograph on glass is made of the drawing. This photograph is clamped to a highly polished plate of zinc, which has been coated with wax or some other substance upon which acid will not act, and then treated with a sensitized solution similar to that used in making camera plates. The zinc plate is then subjected to electric light or to sunlight for a short time, and the pictures are transferred to the sensitized surface, which is etched as in the production of a half-tone. The zinc etching, however, loses the finer shades in reproduction. Its use, therefore, is practically confined to the reproduction of line drawings.

ZINCITE. See ZINC.

ZINOVIEV, GRIGORI EVSEVICH (1883–1936). Russian political leader, he was of Jewish ancestry, his proper name being Apfelbaum. He was educated at Berne University, and while a student he worked for the Russian agitators in Switzerland and formally joined the Bolsheviks as early as 1903. Two years afterwards he returned to Russia where he met Lenin and became an active revolutionary agitator in St. Petersburg. He engaged in journalistic work and propaganda and was a delegate of the Bolsheviks at numerous conferences in other European countries.

After the revolution he held high position in the government, being chairman of the Petrograd Commune, and in 1919 he became chairman of the Third International. As chairman of the Commune he instituted a reign of terror of unexampled ferocity. In 1924, prior to the General Election of 1925, there was published in England a letter of advice to the Socialist leader which, it was claimed, was written by Zinoviev. It led to the defeat of the Socialist party at the polls. As a propagandist of "pure" Leninism, Zinoviev did not take kindly

to the leadership of Stalin, and in 1926 he was expelled from the Communist Party. On making submission he was readmitted, but in 1936 he was executed for alleged participation in treasonable plots.

ZIONISM OR ZIONIST MOVEMENT.

Zionism is the movement which has for its aim the creation of a homeland for the Jews in Palestine. Ever since the destruction of the Jewish state (A.D. 70), the Jews have never ceased to feel a veneration and in many cases a longing for the Holy Land. In their prayers and poetry, the Jews of the Middle Ages expressed this longing, and several abortive attempts were made by messianic pretenders to return to Zion. In the second half of the nineteenth century, wealthy Jewish philanthropists began to buy land in Palestine and settle Jews there, notably the Frenchman Baron de Hirsch who created a large organization known as the Palestine Jewish Colonial Organization (Pica). During this period there had been a literary revival of Hebrew (see HEBREW LANGUAGE) and the new settlers began to use Hebrew as a living language in their daily life. These experiments aroused great enthusiasm among small groups of Jews—"Lovers of Zion"—scattered throughout the world. But in 1897 the movement took a new direction. A Jewish writer from Vienna, Theodor Herzl, deeply moved by Jewish persecution in some countries in Europe, became convinced that the Jewish problem would only be solved if the Jews had an autonomous homeland in Palestine. Large numbers of Jews, he argued, would be able to live a normal life freely in Palestine, and the other Jews of the world could



ZINOVIEV
Photo: Topical



THE ZIONIST MOVEMENT IN BEING

1. Jewish emigrants from Poland arriving at Haifa. 2. General view of the sea-coast town of Jaffa in Palestine. 3. and 4. Work on the land at the Jewish settlement at Nahalal near Haifa.

Photos: Fox

no longer be treated as homeless vagrants. His influence spread after the first "Jewish Congress," and although he was unable before his death to secure a general "Charter of Colonization" for Palestine from the Sultan of Turkey, he succeeded in founding the Zionist Organization and arousing enthusiasm for the slowly growing Jewish settlements.

On 2nd November, 1917, Palestine having been conquered by the British forces (including Jewish regiments) under General Allenby, the British Government declared that "it viewed with favour the establishment in Palestine of a national home for the Jewish people, and would do its best to facilitate the achievement of this object." At the Peace Conference the British were given a "Mandate" in Palestine under these terms, and Jewish immigration into Palestine began. The Palestine Arabs were assured that their rights and property would be respected, but they never welcomed the new system.

From 1919 onwards the Zionist movement continued to bring about great changes in Palestine. The Zionist ideal moved thousands of Jews from all parts of the world to settle in Palestine. At the beginning, the greatest immigration was from Eastern

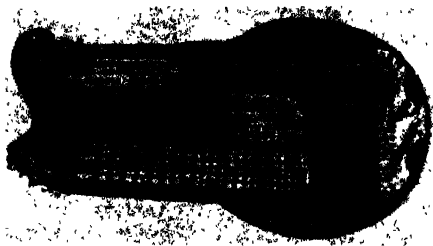
Europe, and more recently, great numbers have come from Germany. In 1919 there were 59,000 Jews in Palestine out of a total of 596,000. In 1937, out of a total of 1,250,000 inhabitants, there are 400,000 Jews, of which some 80,000 are settled on the land. The Jewish rebuilding of Palestine has been achieved partly by voluntary contributions, partly by capitalist investment. In seventeen years, stony deserts have been changed into farms and orchards, marshes have been drained; schools, hospitals, experimental stations, and a Hebrew university have been founded. Tel Aviv, an entirely Jewish town, is a thoroughly modern city with a population of 125,000; Haifa, the new port, has 40,000 Jews; and Jerusalem, 75,000. Although the Arabs have unquestionably reaped enormous benefit from Jewish immigration and British rule, they have never fully accepted either the Jews or the British. There have been riots and bloodshed, most seriously in 1929 and 1936.

ZIRCONIUM, *zir ko' nium*. A rare metallic element found in combination with silica in zircon and some other minerals. Its chemical symbol is *Zr*. It was discovered in 1789 by Klaproth, a German chemist. The metal has been isolated in the form of a

black powder and as a greyish crystalline solid resembling antimony, but the pure metal is very difficult to obtain. It burns readily in air, has a strong affinity for oxygen, and is a good conductor of electricity.

Its oxide, *zirconia*, has been utilized to make brick for furnace linings, as a material for crucibles and other laboratory utensils, in the manufacture of an incandescent lamp used in microscopic work, and for some other purposes.

ZITHER. A flat, stringed instrument with a wooden frame and flat sounding board. The instrument has from twenty-nine to



forty-two strings. When in use, it is placed either upon a table or on the knees; the strings are plucked with the fingers of the right hand, and in order to bring out the melody more distinctly, a metallic plectrum is fitted on the thumb. The zither is the successor of the ancient *cithara*. It is a popular instrument among the inhabitants of Switzerland and Bavaria.

ZODIAC, *zo' di ak*. An imaginary belt among the stars, which contains the orbits of all the major planets. The ancients conceived of this belt as extending 8° on each side of the ecliptic, or path of the sun, since a zone of this width contained the orbits of all the planets known to them. The minor planets, however, or asteroids discovered in modern times, have orbits which take these planets outside the zodiacal belt.

The signs now employed are also based on the Greek arrangement, and are as follows—

Aries	(♈), the Ram,
Taurus	(♉), the Bull,
Gemini	(♊), the Twins,
Cancer	(♋), the Crab,
Leo	(♌), the Lion,
Virgo	(♍), the Virgin,
Libra	(♎), the Balance,
Scorpio	(♏), the Scorpion,
Sagittarius	(♐), the Archer,
Capricornus	(♑), the Goat,
Aquarius	(♒), the Water bearer
Pisces	(♓), the Fishes.

From the earliest known times, it has been customary to divide this zone into

twelve parts, but Hipparchus was the first to divide the zodiac into twelve *equal* portions of 30° each, and his system has remained in use to the present time.

Egyptian astronomers adopted the Greek methods of division, but changed the signs of the zodiac to such living creatures as suited them.

ZODIACAL, *zo di' ak al*, **LIGHT**. A cone-shaped glow of nebulous light seen after twilight in the evening, or just before twilight in the morning, extending upward from the position of the sun, and best seen from regions within the tropics; it has been observed stretching over the whole sky, with a brighter area opposite the sun known as the counter glow (*gegenschein*). The light is brightest near the sun. A common theory is that the phenomenon is caused by the reflection of sunlight projected on multitudes of meteors revolving about the sun.

ZOGU, OR **ZOG**, **AHMED** (born 1893). King of Albania since 1928. He is descended from the Zogolli, one of the chief Albanian families. He was one of the Albanian leaders who forced the abdication of William of Wied in 1914, and after the World War he held the portfolios of Minister of the Interior and Minister of War, and in 1922 he became Prime Minister. In 1924 he was forced to leave the country, but returned later in the year, and in 1925 became President of the Republic. In 1928, when he had gained the support of practically all parties, he allowed himself to be proclaimed king. See ALBANIA.

ZOLA, in French *zo lah'*, ÉMILE ÉDOUARD CHARLES ANTOINE (1840-1902). A French novelist, was born at Paris, and educated at Aix, Paris, and Marseilles. Between 1859 and 1862, he was in extreme poverty, and in 1862 he became a clerk in a Paris publishing house. His first book, *Tales by Ninon* (1864), met with little success. In 1866, however, his *Thérèse Raquin* won him fame and fortune.



ÉMILE ZOLA

Photo:

He next wrote in a starkly realistic style the story of a Parisian family. The work was in several volumes and was entitled *The Chronicles of the Rougon-Macquart Family*. It opens with a novel entitled *The Fortune of the Rougons*. Others in the series are *La Curée*, *The Conquest of Plassans*, *The Fault*

of Abbé Mouret, and His Excellency Eugène Rougon. In 1878 Zola wrote *The Dramshop*, a novel which so vividly described the consequences of drunkenness that all Europe was stirred by it. This was followed by such gloomy but powerful stories as *Nana*; *Paris*, dealing with the hidden life of the Parisian population; *Labour*, discussing the problems of the hand worker; and *Rome*, dealing with the Church.

In January, 1898, Zola took an important part in the defence of Captain Dreyfus, accused of treason (see DREYFUS). The novelist published a denunciatory letter against French officials, entitled *I Accuse*, and was forced by the storm of public indignation to flee to England.

ZOLLVEREIN, *tsol'fer ine*. The German word for *customs union*, a term applied to the commercial union between Prussia and the other States of Germany which prepared the way for the political union which culminated in the German Empire in 1871.

ZONE. A subdivision of the earth's surface, particularly one of the five great climatic belts bounded by imaginary circles parallel with the equator. The largest of these is the Torrid Zone, which extends to 23° 30' each side of the equator, its northern boundary being known as the Tropic of Cancer and its southern boundary as the Tropic of Capricorn. The most densely populated belts are the North and South Temperate zones, which are 43 degrees in width and extend from the tropics of Cancer and Capricorn to the Arctic and Antarctic circles, respectively. The two Frigid zones are 23½ degrees in width, the North Frigid Zone extending from the Arctic Circle to the North Pole, and the South Frigid Zone from the Antarctic Circle to the South Pole.

ZOOLOGY, *zo ol' o ji*. The name zoology means that it is the study of animals. As such it forms one of the major divisions of biological science which deals with living organisms generally, and therefore includes also *botany* and *protistology*, the study of micro-organisms such as bacteria and infusoria. The scientific study of animals includes: (a) their classification (systematic zoology or animal taxonomy) primarily on the basis of their structure (comparative anatomy or animal morphology), their evolution from extinct species (palaeontology) and their development (embryology); (b) their inter-relationships with one another and with the various features of their local environment, with special reference to diet, habits, and geographical distribution (animal ecology); (c) the way in which their organs carry out their work (comparative physio-

logy). Since man is an animal, zoology so defined would include a large number of disciplines which are not usually associated with it, such as human anatomy, medical and systematic physical anthropology, human ecology (i.e. sociology and cultural anthropology) and human physiology. The physiology of human beings is chiefly taught



SKULL OF A MAMMOTH
(*Elephas primigenius*).

Photo: Bond

in relation to medicine and has been largely advanced through experimental study of animals closely related to man. Hence comparative physiology is generally taken to mean experimental study of the functions of organisms less closely related to man, or the study of bodily functions, which have at present little application in medicine and have not received much encouragement from the medical schools. These include particularly, reproduction (experimental embryology) and heredity (animal genetics).

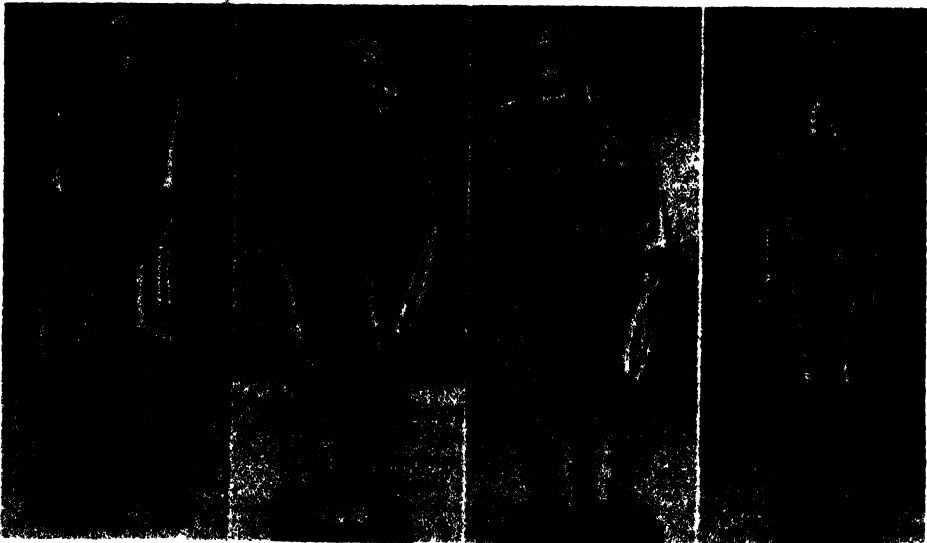
Each of the three main divisions of biology has its application in social life to-day. Systematic zoology is specially important in connection with the identification of parasites of man and livestock, of plants, pests, and of species which "carry" parasites and pests. For instance, since different mosquitoes carry the micro-organisms which produce malaria and yellow fever, the proper precautions against infection depend on being able to distinguish these species. Again the thread worm *Syngamus* produces the fatal disease, *gapes*, in young chicks. The identification of the same parasite, very often found in turkeys which suffer no harm from its presence, warns us against the danger of keeping turkeys and fowls in the same field. Animal ecology enables forecast of fishery resources to be made, and has suggested means of eliminating weeds by introducing species which use them as food (*vide* Enid Charles' book *The Twilight of Parenthood*). The most important applications of comparative physiology lie in the field of genetics which is transforming the practice of stock breeding.

History of Zoölogy. Although the experimental study of the functions of animals has only advanced conspicuously during the past two centuries through the impetus of progress in chemical science and physical apparatus, the studying of comparative anatomy shares the great antiquity of medical studies. We may distinguish three periods of rapid advance in the history of comparative anatomy and systematic zoölogy, associated with three great periods of imperial expansion and exploration.

The first, the results of which are embodied in the *Natural History* of Aristotle, owed its immediate stimulus to the influx of information about unfamiliar Asiatic and African species during the campaigns of Philip of Macedon and Alexander. Indeed it is reported that the Macedonian armies had express orders to collect materials for Aristotle, who acted as tutor to the young Alexander, at a time when the elephant could exercise the imagination of the educated Athenian as the zeppelin exercised the imagination of the educated citizen of London twenty years ago. Aristotle's *Natural History* shows a very close familiarity with the anatomy of mammals, birds, and fishes. It rightly includes sponges in the survey of the animal kingdom, and covers a wide range of facts about the digestive organs, heart, blood-vessels, and reproductive organs of the species of animals then known. Although Aristotle's views on physical science were almost invariably

wrong and stemmed the tide of advance for which the work of the early Greek materialists had prepared the way, his contributions to comparative anatomy are substantial and were not surpassed for thirteen centuries. The brilliant culture of Alexandria, which far outdistanced that of Greece in astronomy, geography, mechanics, optics, and mathematics, made no important contribution to the advancement of zoology. It was essentially urban and, like the Moorish culture which superseded it, received no impetus from the disclosure of a new field of animal life.

Comparative anatomy entered on a new phase in the sixteenth and seventeenth centuries when the discovery of the new world had introduced into everyday use a variety of new plant species such as the potato, tobacco, cane sugar, and cotton. This was accompanied by the formation of trading concerns like the Hudson's Bay Company for exploring the fur resources of the North American forests. Moorish medicine had advanced the codification of medicinal (or supposedly medicinal) plants for purposes of identification, and the practice of classifying new animal species came from the herbalists. The awakening thirst for secular knowledge which accompanied and followed the Reformation exerted its influence in a predominantly rural setting, and medical science had unwittingly unlocked the doors of a new treasure house by the introduction of spectacles.



COMPARATIVE ANATOMY

From Left to Right: Skeletons of a Chimpanzee, Orang-Utan, Gorilla, Human Being (female).



SOME OF THE MOTHS

1. Bordered Beauty. 2. Redstraw Hawk Moth. 3. Wood Leopard. 4. Small Dark Yellow Underwing. 5. Death's Head Hawk Moth.
 6. Orange Underwing. 7. Scarlet Tiger. 8. Common Tiger. 9. Crimson Underwing. 10. Spotted Sulphur Moth. 11. Lacewing.
 12. Barred Yellow. 13. Common Emerald. 14. Yellow Underwing. 15. Great Brocade.

The simple microscope, which, like the telescope, was a by-product of the spectacle industry, shared in the prestige which the telescope derived from the importance of astronomy in an age of expanding navigation, and led to discoveries of immense importance at the latter end of the seventeenth century. It revealed the existence of a teeming life of minute organisms whose bodies are not divided into "cells" or microscopic bricks like those of familiar animals and plants. It showed that seminal fluid is made of minute moving elements very much like them. It exposed the flow of the blood in the minute vessels (capillaries) which connect the arteries and veins. It led to the recognition of the curious system of respiratory tubes or tracheal system which interpenetrates the bodies of insects. It made it possible to detect the eggs of small organisms. It thus stimulated experiments which established the fact that all familiar animals have parents similar to themselves. The net result was that comparative studies of the structure of animals could now progress with clearer knowledge of the nature of the circulatory, respiratory, and reproductive processes. In particular the recognition of species as assemblages of individuals owing their existence to common parentage gave the task of classifying animals a more definite outline, embodied in the monumental work of Ray and Linnaeus in the first half of the eighteenth century.

This phase was telescoped into a third which followed the discovery of Australia, the introduction of steam navigation and the great voyages of exploration undertaken in the first half of the nineteenth century. These facts contributed to a spectacular influx of new knowledge concerning the diversity of animal life, including such anomalous types as the duckbilled platypus (which see). Simultaneously two other facts of social life contributed to encourage zoological studies. The extension of mining—and especially coal-mining—and canal construction were accompanied by the rise of the new science of geology, which encouraged the systematic study of fossil forms; while, at the same time, improvement in the design of scientific instruments bore fruit in the compound microscope, just when interest in the micro-organisms of fermentation and disease was beginning to attract serious attention. The most important consequence of this was that the nature of development and of reproduction was studied far more thoroughly. New knowledge of the reproductive process paved the way for experimental study of heredity.

To-day we take it for granted that cater-

pillars come from eggs laid by butterflies just as chicks come from eggs laid by the hen. In the seventeenth century, when the principle of *biogenesis* was first accepted as a universal rule of Nature, this was a startling discovery. Towards the end of it, Grew and Camerarius proved that the seed of a flowering plant is produced by the fertilizing action of the pollen upon the ovules in the pistil. That the *sperm* or motile element of seminal fluid is actually essential to the fertilization of the animal egg was still in dispute till the process of development began to be studied intensively about 1830. At the time when Lamarck issued the first noteworthy speculations on the evolution of living beings it was still commonly believed that the egg is a miniature replica of the full grown organism, the word *homunculus* being used for the suppositious miniature human being supposed to reside in the human womb from the beginning of conception. Eighteenth-century biology recognized no fundamental interruption in the structural organization of parent and offspring, and could lightly accept Aristotle's belief that we hand on to our offspring the modifications which our own bodies undergo in a lifetime.

By introducing the "cell doctrine" the compound microscope therefore raised a new problem about how inheritance takes place. It showed that our bodies and those of all familiar animals and plants (as opposed to micro-organisms) are made up of minute bricks called *cells*, and that the central fact of sexual reproduction is the same in animals and plants. Thus the new being starts its existence as a single cell produced respectively from the body of the male and female parent. In the lower plants, as in all animals, the former are always motile and produced in large numbers in the seminal fluid. The latter are immobile and vary in size according to the quantity of storage material they contain for the nutriment of the growing embryo. The human egg cell contains little nutrient material and is just visible to the eye. The egg yolk of birds is also a single cell, vastly swollen by inclusion of reserve materials. That one sperm and one only enters the egg was not directly observed till about 1875, though it had been concluded to be true indirectly through studies on early development of mammals thirty years earlier. When the egg has been fertilized by a sperm the combined cell or fertilized egg proceeds to divide into two, a process which is repeated again and again. From the resulting mass of cells various groups begin to get arranged to form embryonic organs like the gut, nerve cords, heart, etc., and the developing organism progressively

develops the organization characteristic of its destiny.

Growing knowledge of the development of the individual (*embryology*) encouraged closer study of the texture of individual cells (*cytology*). The substance (*protoplasm*) of all cells contains a typically spherical denser region called the *nucleus*, which takes up basic dyes like logwood. When cells divide, the nucleus resolves itself into rod-like, deeply staining bodies called *chromosomes*, each of which splits into equal halves which go to make up the two nuclei of the daughter cells. Thus the number of dividing chromosomes in the ordinary cells of the body is fixed. About 1880 an important discovery precipitated the challenge which Weismann issued to the prevalent belief in the "inheritance of acquired characters." In the formation of the egg cell and sperm, the chromosomes do not split, but associate in pairs. One member of each pair is used to form the nucleus of the sperm or egg, so that sperms and eggs contain half as many chromosomes as the ordinary cells of the body. At fertilization the normal number is restored by the union of the sperm nucleus with the egg. Only the nucleus of the sperm generally enters the egg. So what we inherit from our parents are our chromosomes, and everything we mean by heredity in the biological sense is what chromosomes are made of. We do not inherit our parents' noses. Our parents had the sort of noses they had, and we have the sort of noses we have, partly because we have chromosomes made up of the same sort of material, and partly because the environment in which we grow affects the influence this chromosome material will exercise. When biologists began to be clear about the material basis of heredity they were compelled to put accepted dogmas to the test of experiment. This gave an impetus to the study of heredity (genetics), which has now become one of the most important branches of zoology.

Interest in the problems of heredity and variation also received encouragement from another source. The expansion of physiological knowledge which accompanied the rise of chemistry promoted more careful study of the anatomy of the lower animals. The travels of men like A. R. Wallace forced zoologists to recognize that the characteristics of animals are very closely connected with how near they live to one another, while the record of the rocks unveiled as "vestiges of creation" missing links like the bird-lizard *Archaeopteryx*. The whole picture suggested was an unfolding of ever-increasing divergence of structure, as animal life has spread over the globe through the vastness of geological time. The evolution-

ary doctrine of the early Greek materialists revived at the latter end of the eighteenth century in the writings of Erasmus Darwin (grandfather of Charles Darwin), Lamarck, and St. Hilaire, took root more firmly and gained universal assent among scientific men in the latter half of the nineteenth century, chiefly through the influence of Charles Darwin and A. R. Wallace, who offered the known facts of heredity and variation in stock-breeding and animal domestication as a sufficient explanation.

Survey of the Animal Kingdom. Living beings may be divided into three main groups, animals, plants, and *protista*. The last-named are micro-organisms which are not divided into separate cells. In the past it has been customary to classify some of them (e.g. the bacteria) as simple plants, others (e.g. amoeba, infusoria, etc.) as simple animals (protozoa), according as they resemble most of the individual cells of which the bodies of ordinary plants and animals are made up. The bodies of animals are made up of naked cells which contain no green colouring-matter, "chlorophyll," which enables the typical plant to build up organic from inorganic matter in sunlight. Plant cells, on the other hand, are enclosed in an envelope ("cell wall") of cellulose, the material of which paper is composed. Leaving aside the Protista, typical animals may for the most part be grouped together in about a dozen major assemblages or *phyla*, the majority of which consist of species closely related in the evolutionary history of animal life. Over half a million distinct species have been named. In modern zoological classification each species receives two names, one of which is common to closely related species grouped together in the same *genus*. Thus the common cat is *Felis domesticus*, and shares the first or generic name *Felis* with several other species such as the lion (*Felis leo*), and the tiger (*Felis tiger*). Inside a species we can sometimes distinguish local races or varieties (like the domestic breeds) which can freely mate and produce fertile offspring if permitted; but for most practical purposes the species is taken as the smallest unit of classification. Two individuals of opposite sex belong to different species if they do not mate together or if they produce infertile hybrids like the *mule* when they do so. Genera each containing species which closely resemble one another are grouped with others which resemble them most closely in families. The names of all families end in *-idae*. Thus the genus *Felis* is one of several genera of the cat family *Felidae*. Families again are combined in *orders*, e.g. the *Carnivora* to which the *Felidae* or

cat family, the *Ursidae* or bear family and the *Canidae* or dog family are assigned. Orders are combined in classes, e.g. the *Mammalia* which include, among others, the *Carnivora* (dogs, cats, and bears), and the *Primates* (men, monkeys, and marmosets). Classes again are united in the



RED KANGAROO AND YOUNG
(Marsupial).
Photo: Bond

major divisions of the animal kingdom called *phyla*, e.g. *Chordata* to which mammals and fishes both belong. Any of these ranks may be subdivided. For instance, mammals are subdivided into three sub-classes, one of which includes the duckbilled platypus, one the pouch-bearing species like the opossum and kangaroo, and the other includes all the mammals of Europe, Africa, and Asia. Again the *Chordata* is divided into several sub-classes of which the *Vertebrata* includes all familiar forms (fishes, reptiles, birds, mammals).

Here is a brief outline of the main *phyla*, some of their subdivisions, and a few distinguishing characteristics which unite the animals placed in them.

Phylum I—Porifera. This includes the sponges (which see). The canals are lined by cells with vibratile filaments ("cilia") which maintain a constant stream of food particles. Masses of sperms and egg cells are found embedded in the gelatinous body walls along with spicules. There are no separate digestive organs, no blood-vessels, nerves, or sense organs.

Phylum II—Coelenterata. Organisms in which the hollow body consists of two main cellular layers separated by a gelatinous middle region. A single orifice, the mouth, leads into the central cavity which is usually surrounded by tentacles, and acts as the digestive organ of the body. Digested food-stuffs diffuse through the body substance without the aid of blood-vessels to carry them. There may be muscle fibres, more or less distinct from the lining cells of the cellular walls, connected with simple sense

organs on the outer surface by a continuous network of nerve fibres. In addition to sexual reproduction, budding is common, and many species form sedentary colonies from which free-swimming sexually equipped individuals are liberated. The three main classes are the *hydrozoa* (zoophytes); *scyphozoa* (jelly fishes); and *actinozoa* (sea-anemones and corals).

Phylum III—Platyhelminthes. Flattened worm-like creatures which are generally hermaphrodite, i.e. the sexes are combined in one individual producing both seminal fluid and eggs. The digestive cavity has a mouth but no anus. The nervous system consists, as in all the remaining *phyla*, of a peripheral portion—nerve trunks—and a central mass where nerve cells are concentrated. There are no blood-vessels. The muscular system is well developed. There is a system of canals lined with ciliated cells believed to be excretory organs. The three principal classes are *Turbellaria* (free-living flat worms found under stones in ponds and rock pools); *Trematoda* (parasitic worms called "flukes," including the liver fluke which causes sheep rot); *Cestoda* (tape worms—parasites devoid of a gut). Sometimes associated with the *Turbellaria* is the class of free-living unsegmented worms called *Nemertinea*, common in rock pools. Unlike the above, but



PLUMOSE ANEMONE
(Coelenterata).
Photo: Bond

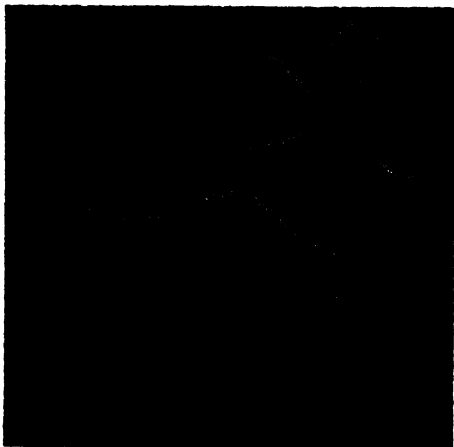
like all the remaining *phyla*, they have an anus, and are sometimes placed in a separate phylum.

Phylum IV—Nemathelminthes. Smooth elongated worms with a tapering body. They have a mouth and anus, but no blood-vessels

or sense organs of vision and balancing. They are mostly parasitic and include the pin worm, which often infects the digestive tract of children, in addition to more dangerous parasites of man like *Filaria*, which produces elephantiasis of man, in the tropics, and of stock and crops. Species of *Tylenchus*, *Heterodera*, and other genera form galls on wheat, beet, etc. Nearly all the forms put in this phylum are placed in a single homogeneous class, the *Nematoda*, called thread worms.

Phylum V—Rotifera (*Trochelmenthes* or *Rotatoria*). These are complex organisms of exceedingly minute dimensions living in fresh water. They have a well-developed digestive system, nervous system, and supposedly excretory organs. Their distinguishing characteristic is a disk fringed with vibratile cilia in front of the mouth, giving the appearance of a rotating wheel, whence their name "wheel animalcules." The males, as with bees, are produced by parthenogenesis or virgin birth, i.e. from eggs which are not fertilized.

Phylum VI—Echinodermata. Radially symmetrical marine animals in which the whole body is enclosed in a carapace of calcareous plates. Along five typical grooves of the surface are double rows of pores through which fine muscular suckers,



STARFISH
(Echinodermata).
Photo: Bond

the "tube feet," are everted. There are four classes: *Asteroidea* (star fishes); *Echinoidea* (sea urchins); *Ophiuroidea* (brittle stars); *Crinoidea* (sea lilies). There are many fossil representatives of all the classes. Like the animals placed in the next four phyla, the egg, fertilized in the open sea, starts life as

a free-swimming larva, which is covered with cilia-bearing cells, and passes through a complicated metamorphosis into the adult form.

Phylum VII—Molluscoidea. In this group are included a number of sedentary, mostly marine organisms with very doubtful affinities, the main resemblance being the



LESSER OCTOPUS
(Mollusca).
Photo: Bond

circling or groove of tentacles in the mouth regions. The two principal classes, each with fossil representatives, are the *Brachiopoda* (lamp shells), and the *Polyzoa* (sea mats), which superficially resemble hydroids. They are sedentary, often hermaphrodite, and form colonies by budding.

Phylum VIII—Annelida. These are worms in which the whole body is segmented and typically provided with bristles by which locomotion is effected. There is a well-developed system of contractile blood-vessels. The three main classes are: *Oligochaeta* (earthworms); *Hirudininea* (leeches); and *Polychaeta* (marine bristle worms, like the lug worm used for bait and the "sea mouse.") They are often hermaphrodite.

Phylum IX—Mollusca. Unsegmented animals with a well-developed heart which pumps the blood from leaf-like gills to the tissues. There are few characteristics common to the whole phylum, but each class shows unmistakable likeness to the central group which includes the *Chitons*. The other three principal classes are: *Lamellibranchiata* (*Pelecypoda*) or oysters, mussels, etc.; *Gastropoda* (snails, slugs, whelks); and *Cephalopoda* (nautilus, octopus, cuttle fish). The *Gastropods* are mostly hermaphrodite.

Phylum X—Arthropoda. This contains more species than any other phylum. Its members have segmented bodies, like the *Annelida*, from which they differ in having jointed legs, the muscles of which are enclosed in a hard external skeleton, a heart which fills itself by contractile pores or ostia from a main blood cavity into which



LOBSTER
(Arthropoda).
Photo: Bond

the finer vessels discharge, and limbs wholly (mandibles) or partly (maxillae) modified as jaws. The oldest group, the *Trilobita*, is completely extinct and combines characteristics of the other classes of which the principal ones are: *Crustacea* (woodlice, crabs, shrimps, lobsters, water fleas, and barnacles), *Myriapoda* (millipedes and centipedes); *Insecta* or *Hexapoda* (the true insects); and *Arachnida* (spiders, scorpions, ticks, harvestmen, and king crabs).

Phylum XI Chordata Apart from a few groups of simpler organisms like the sea squirts or *Tunicata*, which start their lives as creatures something like tadpoles and generally settle down to form colonies of hermaphrodite adults capable of budding off new individuals, the overwhelming majority of this assemblage are placed in the sub-phylum *Vertebrata*. All Vertebrates have a highly characteristic central nervous system which lies dorsal to the gut (spinal cord) and expands at the fore end into a brain with a characteristic group of nerves



PRAYING MANTIS
(Arthropoda).
Photo: Bond

from the great sense organs (eye, internal ear and nasal organ) of the head, and others supplying the eye muscles, heart, etc. At some stage of life the heart pumps blood forward round a series of vessels surrounding the throat, which may be perforated by clefts bearing gill filaments in the aquatic classes. Such clefts are present in the embryos of the land classes, but do not bear gill filaments. Throughout the sub-phylum there is a characteristic group of organs, the "ductless glands," which include the thyroids, adrenals, etc. The same type of



RHINOCEROS BEETLE
(Arthropoda).
Photo: Bond

digestive juices are secreted into the alimentary canal by characteristic organs called the liver and pancreas throughout the group, and the system for excretion of nitrogenous waste by two "kidneys" has an essentially similar structure in all members. There are five classes of *Vertebrata*, viz.—

(a) *Cyclostomata* (hagfishes and lampreys), which resemble fishes in their respiratory and circulatory arrangements but differ in lacking jaws, paired limbs or well-defined vertebrae. The spinal column is represented by a gelatinous rod or "notochord" which is present in the embryo of higher vertebrates, but generally disappears in later life.

(b) *Pisces* (fishes). Like *Cyclostomes* they



CARP
(Pisces).
Photo: Bond

have gills and a heart with only one auricle (except in the lung-fishes) receiving the blood from the tissues. They differ in possessing paired fins.

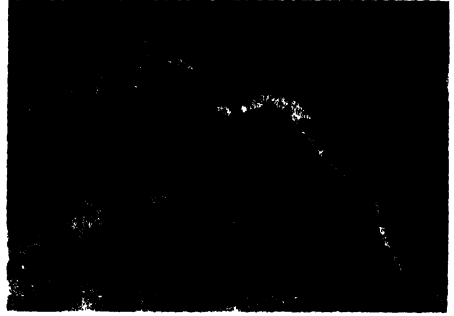
(c) *Amphibia* (newts, salamanders, frogs, toads). Generally these start life as tadpoles with circulatory and respiratory organs like

tilized egg being enclosed in a shell. The body is covered with scales. The heart connects with the main artery of the trunk by two arches, one of which only (left in mammals, right in birds) persists in the next two groups.

(e) *Aves* (birds). These are warm-blooded



SURINAM TOAD WITH EGGS EMBEDDED IN ITS BACK
(Amphibia).
Photo: Bond



ROYAL PYTHON
(Reptilia)
Photo: Bond

fishes, and sometimes retain the latter throughout life. They always have lungs (as do some fishes) which usually replace gills in the adult and, like the three remaining classes of typical land vertebrates, have five-fingered limbs. The heart has separate auricles receiving blood respectively (left

forms with feathers and fore limbs modified for flight. In most other respects their anatomical organization is typically reptilian.

(f) *Mammalia*. Warm-blooded land vertebrates in which the body is covered with hair. The young are suckled and, except in



STOLMAN'S ESCURRIO (FROG)
(Amphibia).
Photo:



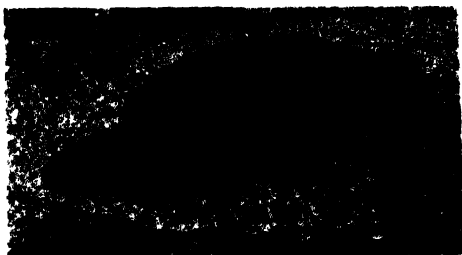
NILOTIC CROCODILE
(Reptilia).
Photo: Bond

from the lungs, and (right) from the rest of the body, but the ventricle which pumps blood out of the heart is not divided as in the remaining groups.

(d) *Reptilia* (crocodiles, lizards, snakes, tortoises). These are cold-blooded land vertebrates with no aquatic larva, the fer-

the case of two primitive egg-laying genera (duckbill and spiny ant-eater or Echidna), are born alive.

Since they possess a hard internal skeleton supporting the trunk, protecting the brain and serving for the attachment of the limb and jaw muscles, the vertebrates have left a rich record in fossils. On that account great attention has been given to the minutiae of the skeletal anatomy (osteology) which is highly characteristic of the several groups. The fossil record provides abundant evidence of transitional forms like the bird-



DUCK-BILLED PLATYPUS

(Mammalia)

Photo: Bond

lizard Archaeopteryx and the South African Triassic reptiles which fade into the Mammalia

ZOROASTER, *zo ro as' ter*. A Persian, or Iranian, reformer and teacher, the founder of an ancient religion. He was regarded in antiquity as the father of the wisdom of the Magi (which see). Ancient records speak of several philosophers, of different nationalities, all known by this name. But the great teacher probably was a native of Bactria, one of the provinces of ancient Persia. The age in which he lived is also a moot point, ranging from 2400 to 600 B.C. His life appears to have been one of retirement and spiritual contemplation. According to some accounts he lived in solitude on a mountain. His work consisted in arraying a confused mass of earlier teaching.

Zoroastrianism. The ancient religion of the Persians was Mazdaism, the reforms and spiritualized teachings imparted by Zoroaster and his followers changed it to Zoroastrianism. Zoroaster taught that all forms of life and all forms of creation are the resultant of two principles, forces, or tendencies, their names, as given in the Zend-Avesta, are simply the *better principle* and the *worse one*, but these principles soon become personalized as Ahura Mazda and Angra Mainyu, and later still as Ormazd and Ahriman. The teachings of this religion prophesied the coming, at an uncertain day, of a Messiah or Saviour (Saoshyant) to rout the powers of evil, to be followed by a final judgment upon all men. The Parsees (which see) are the modern followers of this cult

ZUIDER ZEE, OR ZUYDER ZEE, *zi der ze'*. A gulf penetrating far into the Netherlands, and separated from the North Sea by the West Friesian Islands. Originally, the Zuider Zee was a lake in the midst of extensive fens and marshlands; it acquired its present character as a result of inundation occurring from the twelfth to the fourteenth century. It is extremely shallow, having an average depth of less than 15 ft. at low water. Its greatest length, which is from north to south, is 85 miles; it has a maximum breadth of 45 miles, and an area of a little over 2100 sq. miles. See NETHERLANDS.

An attempt to drain the Zuider Zee and



ZULUS

1. Zulu playing a Jew's Harp. 2. Front view of a girl's headdress. 3. The backview of the headdress. 4. A warrior. 5. Zulu women.

Photos: Cherry Kearton

to reclaim the land is now being made. Large areas have been drained and devoted to agriculture. It is hoped to add 550,000 acres to the area of the country in 15 years' time.

ZULULAND. A territory of southern Africa, forming the north-eastern portion of the province of Natal in the Union of South Africa. It covers an area of 10,427 sq. miles, and has a population of 250,000 (4000 whites). See illustration on page 4579.

Early in the nineteenth century, the Zulus overran great portions of South Africa. The Zulus, part of the original African Bantu stock, reside in *kraals* or villages, which they build as circular enclosures, with a second inner ring fence forming a cattle pen. The last Zulu king was Dinizulu, son of a famous ruler named Cetewayo, whose royal kraal was at Ulundi; he was defeated there after severe fighting in the Zulu war of 1879.

The British occupied Zululand in 1887 and governed it through a commissioner responsible to the administrator of Natal, and ten years later it was annexed to Natal. In 1906 there was a native revolt, but the leaders were punished, and a lasting peace followed. Agriculture and cattle raising are the chief occupations. Since 1905, white planters have cultivated sugar cane in a region along the coast, and in 1922 cotton was introduced.

ZÜRICH, zû'rik. See SWITZERLAND.

ZUYDER ZEE, zî' dūr zē'. See ZUIDER ZEE.

ZWINGLI, tsving' lē, ULRICH, or HULDRICH (1484-1531). A Swiss reformer, the contemporary of Martin Luther and the leader of the Protestant Reformation in his country; born at Wildhaus in the canton of St. Gall. In his early writings, he protested against the practice of employing Swiss troops as mercenaries in European wars. At Einsiedeln, a celebrated centre of pilgrimage, Zwingli first began to shape his ideas of reform. He opposed Papal power in 1520, when he offered a public exhortation to his people to support the stand that Martin Luther had already taken. He preached against fastings, the veneration of saints, and the celibacy of priests. In 1523 the council of Zürich upheld him, and decided to separate the canton from the bishopric of Constance, thus giving sanction to the Reformation.

Convinced that, without a strong confederation, nothing by way of reform of religion could be effected, Zwingli himself entered upon the battlefield of Kappel as field chaplain on 10th October, 1531, in opposition to the Catholic cantons who had revolted, and there met his death while carrying the evangelical banner.

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